

# ELECTRICAL REVIEW

FRIDAY  
17 JUNE 1960

WEEKLY  
PRICE 1s 6d

**No other standard motor  
has all these features!**



**All cast-iron exterior, with  
finger-proof cowl to BS.2817.**

**Non-corrodible, polyester  
resin, external fan.**

**Drain holes with easily  
detachable plastic plugs.**

**Provision for fitting earthing  
terminal.**

**Weatherproof type terminal  
box with 4-screw fixing.**

**Nameplate with full details  
including bearing sizes and  
grease grades.**

## **CLASS 'D' A.C. motors**

**DELIVERIES from stock**

*Are you receiving the monthly  
STOCK LIST?*

*If not, write to:*

*The ENGLISH ELECTRIC Co., Ltd.,  
Industrial Motor Works, Bradford.*

**THE NEW  
'ENGLISH ELECTRIC'**

**class 'D' range of industrial motors**

The new range of 'ENGLISH ELECTRIC' totally enclosed fan-cooled squirrel cage motors are interchangeable with ventilated motors to BS.2960 and have Class 'E' insulation for a permissible temperature rise of 65°C. For a given horsepower this means: SMALLER SIZE; LOWER WEIGHT; LESS COST.

**POLICY** Although class 'D' is such an advance over existing types, we intend for customers' convenience still to produce our 'B' frame motors to BS.2083 for an indefinite period.

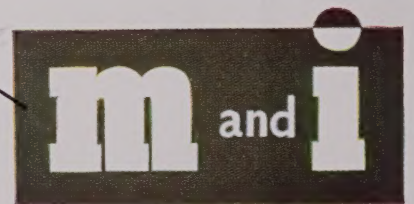
THE ENGLISH ELECTRIC COMPANY LIMITED, MARLBOROUGH HOUSE, STRAND, LONDON, W.C.2  
WORKS: STAFFORD • PRESTON • RUGBY • BIRMINGHAM • LIVERPOOL • ACCRINGTON



UPPER PHOTOGRAPH by courtesy of AEI—Birlec Ltd.  
LOWER PHOTOGRAPH by courtesy of AEI—Hotpoint Ltd.

## M & I PRODUCTS in hot spots and cold places

For safety and efficiency under all conditions it is essential to use only the finest materials. The name M & I is synonymous with all that is best in electrical insulation.



**THE MICANITE & INSULATORS CO., LTD.,**

Empire Works, Blackhorse Lane,  
Walthamstow, London, E.17.

Telephone: Larkwood 5500.

Telegrams: Mytilite, London, Telex.

Telex: 25183.

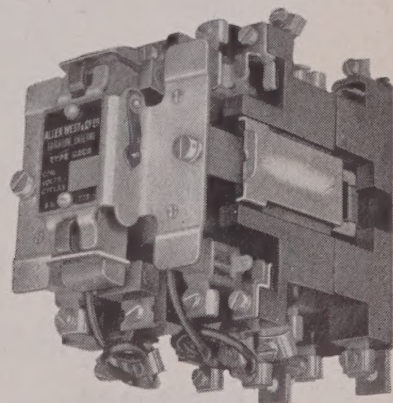
MICA, MICANITE, "PAXOLIN", "PANILAX", EMPIRE VARNISHED INSULATION ON PAPER, CLOTH, SILK, NYLON, GLASS & TERYLENE BASE, SILICONE INSULATION, HIGH VOLTAGE BUSHINGS, FIBROUS MATERIALS, INJECTION MOULDINGS & EXTRUSIONS IN PVC AND OTHER THERMOPLASTICS



# Have you heard?



The first models in the new range  
of Allen West unit type contactors  
will be shown at the  
International Machine Tool Exhibition  
at Olympia, June 25 - July 8

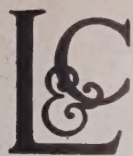


See them on

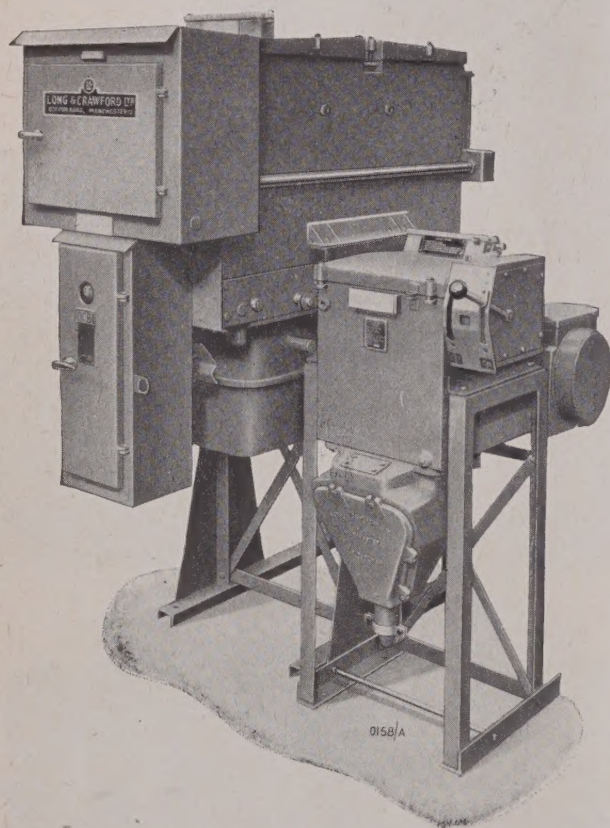
## STAND 640

ALLEN WEST & CO LTD BRIGHTON · Telephone: Brighton 66666 · Telegrams: Control, Brighton  
*Engineers and Manufacturers of Electric Motor Control Gear and Switchgear*  
SUBSIDIARY COMPANIES IN CANADA, SOUTH AFRICA AND RHODESIA · AGENCIES THROUGHOUT THE WORLD





## OUTDOOR CIRCUIT BREAKERS



Off load oil isolators on both sides of Breaker.

Earthing of circuit through the Breaker. (Also bus-bar earthing if required.)

Full safety interlocks to prevent maloperation.

Circuit testing after earthing.

Built to line up with existing outdoor oil switches, etc.

Totally oil and compound insulated.

Breaking Capacity Rating — 250 MVA at 6.6 kV and 11 kV.

Impulse Tested.

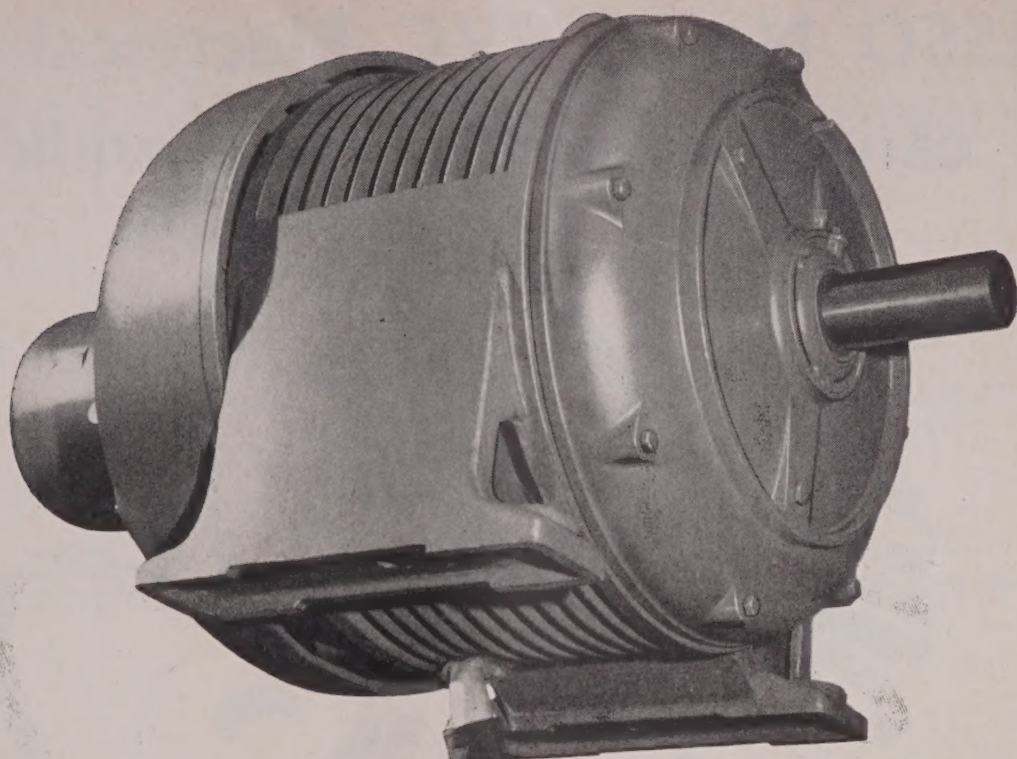
**6.6 kV to 11 kV  
250 MVA**

*Illustrated is a type 'WPD2' Circuit Breaker connected to a type 'J' 400 amp Oil Switch.*

# LONG & CRAWFORD LTD.

GORTON ROAD - MANCHESTER 12





**GET BROOK  
TO QUOTE  
NEXT TIME!**



**LARGE  
TOTALLY  
ENCLOSED  
FAN COOLED  
MOTORS  
up to 250  
horsepower**

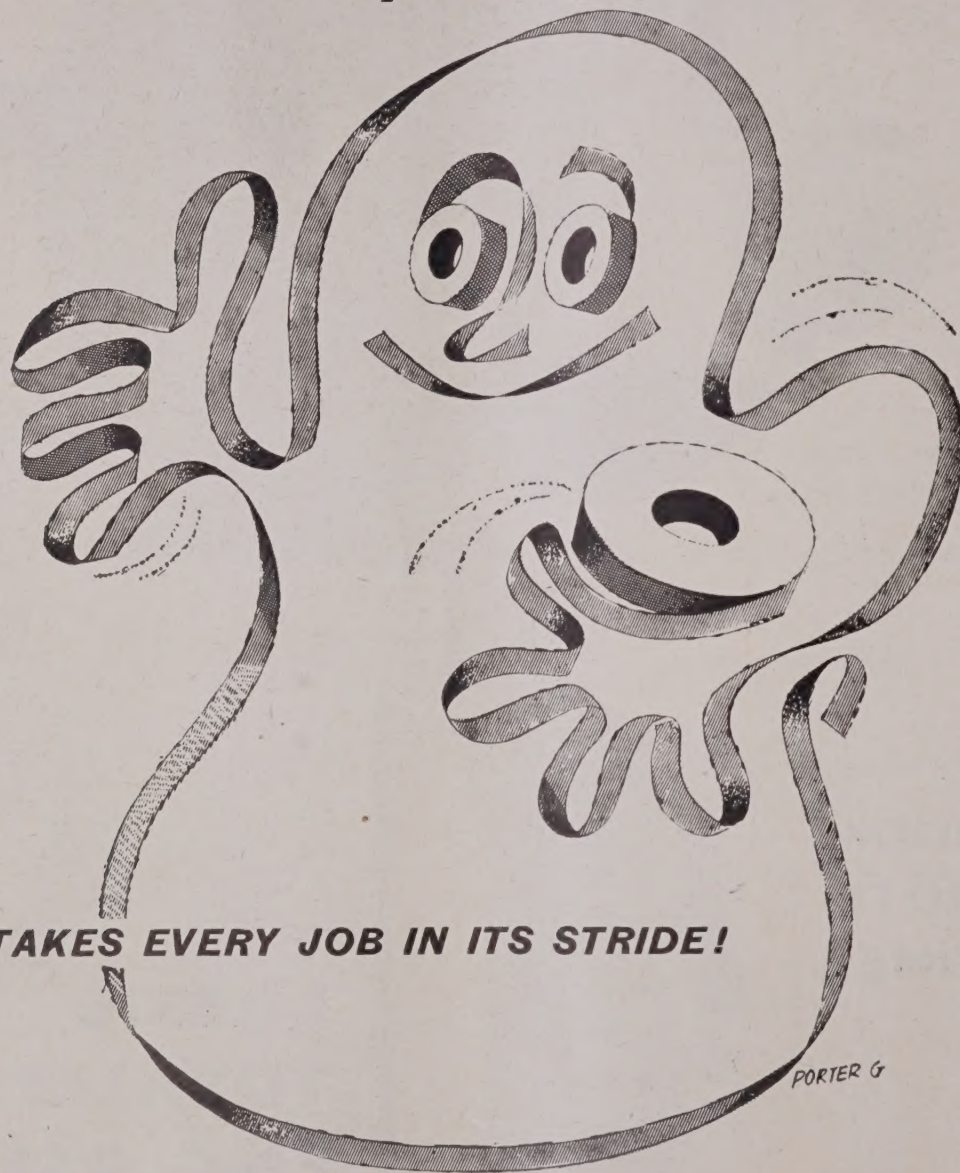
**HUDDERSFIELD**



**ENGLAND**



# LASSO No. 92 PVC Electrical Tape can do everything but walk —



**YET IT TAKES EVERY JOB IN ITS STRIDE!**



Lasso No. 92 has so many properties, so many uses, we could fill this page with them. And dull reading it would make. A lot of stuff about pliability, water resistance, acid resistance, wrapping, jointing, insulating, binding, splicing — *that* sort of thing. Far better send for our alert young representative, *he* makes it sound interesting. Ask your secretary to drop us a line today.

**SEND TODAY FOR OUR WALKIN', TALKIN', THINKIN' REP**

## LASSOTAPES

for all electrical and industrial uses

SMITH & NEPHEW LIMITED • WELWYN GARDEN CITY • HERTFORDSHIRE





# When the 'right time' is essential

in process cycles

or welding current duration

depend on **AEI** electronic timers

## GENERAL PURPOSE AND PROCESS WORK—TYPE FU21

- ▶ Available from stock in timing ranges covering 0.5 to 180 seconds
- ▶ No moving parts in timing circuit
- ▶ Easily arranged to operate in individual control schemes
- ▶ High repetitive accuracy
- ▶ Suitable for 40/60 cycle a.c. supplies of 110, 200/250, or 400/440 volts

## WELDING—TYPE FW19

- ▶ For control of resistance welding machines
- ▶ Timing range 0.1 to 10 seconds
- ▶ No moving parts
- ▶ Supplied with separate rheostat for remote setting
- ▶ Available from stock for immediate delivery

*Please write for further technical details and  
a copy of our brochure 'Electronics in Industry'.  
Our engineers will be pleased to help you with  
your automatic timing problems.*



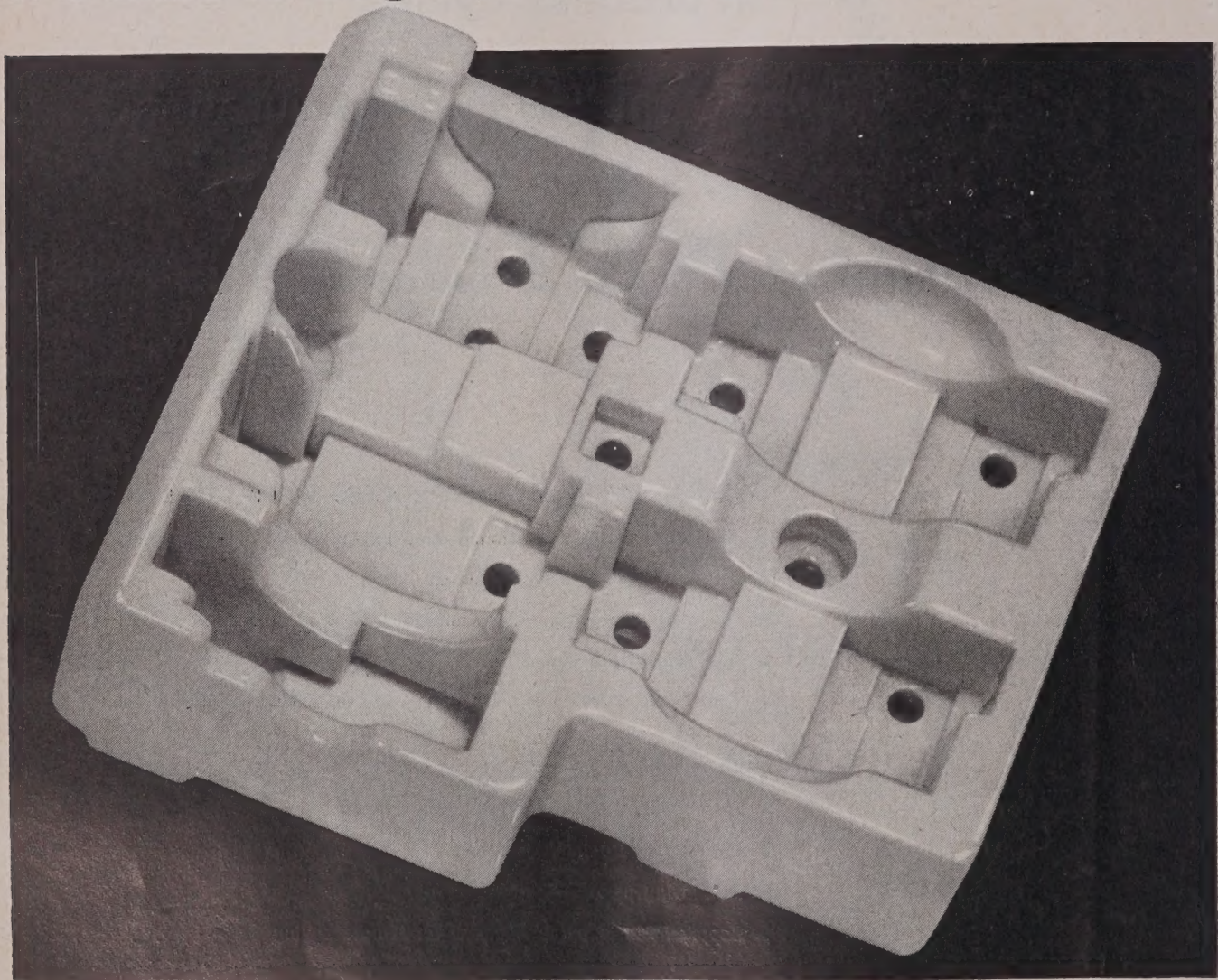
**Associated Electrical Industries Limited**

**Electronic Apparatus Division**

NEW PARKS, LEICESTER, ENGLAND



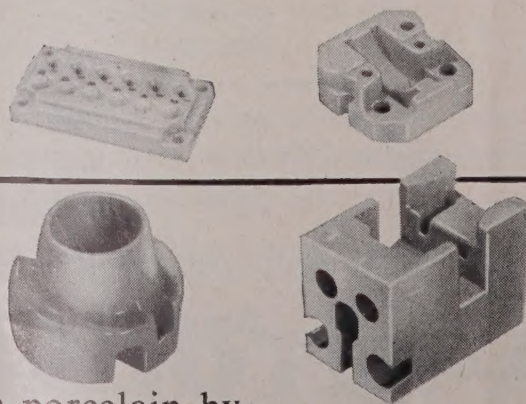
# It's safe to say **T.T. PORCELAIN**



This is an intricate die-made porcelain insulator manufactured to a customer's specification. It set many problems of design and manufacture, and close tolerances demanded precision and know-how at every stage of production.

But these problems are daily routine at Taylor Tunnicliff. This insulator is typical of thousands made each day in our three large factories. Porcelain, still the world's best insulating material for this class of work, is safe in our hands.

May we examine your insulation problems for you?



Perfection in porcelain by  
**TAYLOR TUNNICLIFF & CO., LTD**

Head office: EASTWOOD • HANLEY • STOKE-ON-TRENT • Tel: STOKE-ON-TRENT 25272-5  
 London office: 125 HIGH HOLBORN • LONDON • W.C.1 • Tel: HOLBORN 1951-2



# Two New Water Heater Control Switches

## Volex

**D.P. INSULATED  
SWITCHES**  
WITH EARTH TERMINAL

20 Amp. and 30 Amp.  
**SURFACE MOUNTING**  
BROWN OR CREAM FINISH

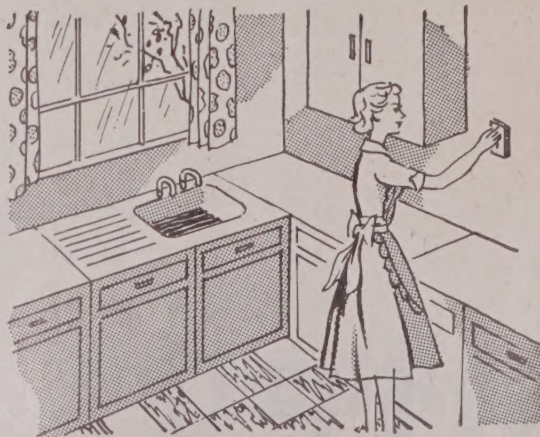
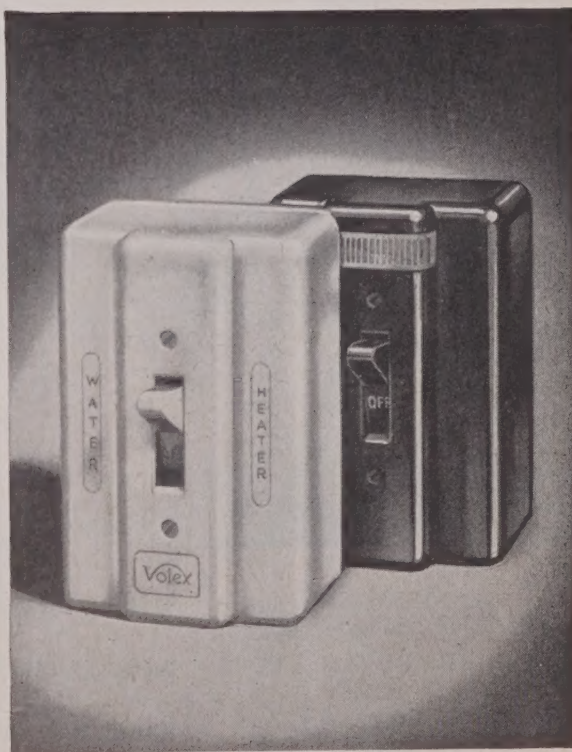
**WITH SELF-CONTAINED  
MOUNTING BLOCKS**

### 20 AMP. A.C.

**V/5303** Without Pilot light ... 6/8d. each  
**V/5303CR** „ „ Cream 7/8d. „  
**V/5304** With Pilot light 9/- „  
**V/5304CR** „ „ Cream 10/- „

### 30 AMP. A.C.

**V/5203** Without Pilot light ... 7/8d. each  
**V/5203CR** „ „ Cream 8/8d. „  
**V/5204** With Pilot light ... 10/- „  
**V/5204CR** „ „ Cream 11/- „



**VOLEX ELECTRICAL PRODUCTS LTD.**

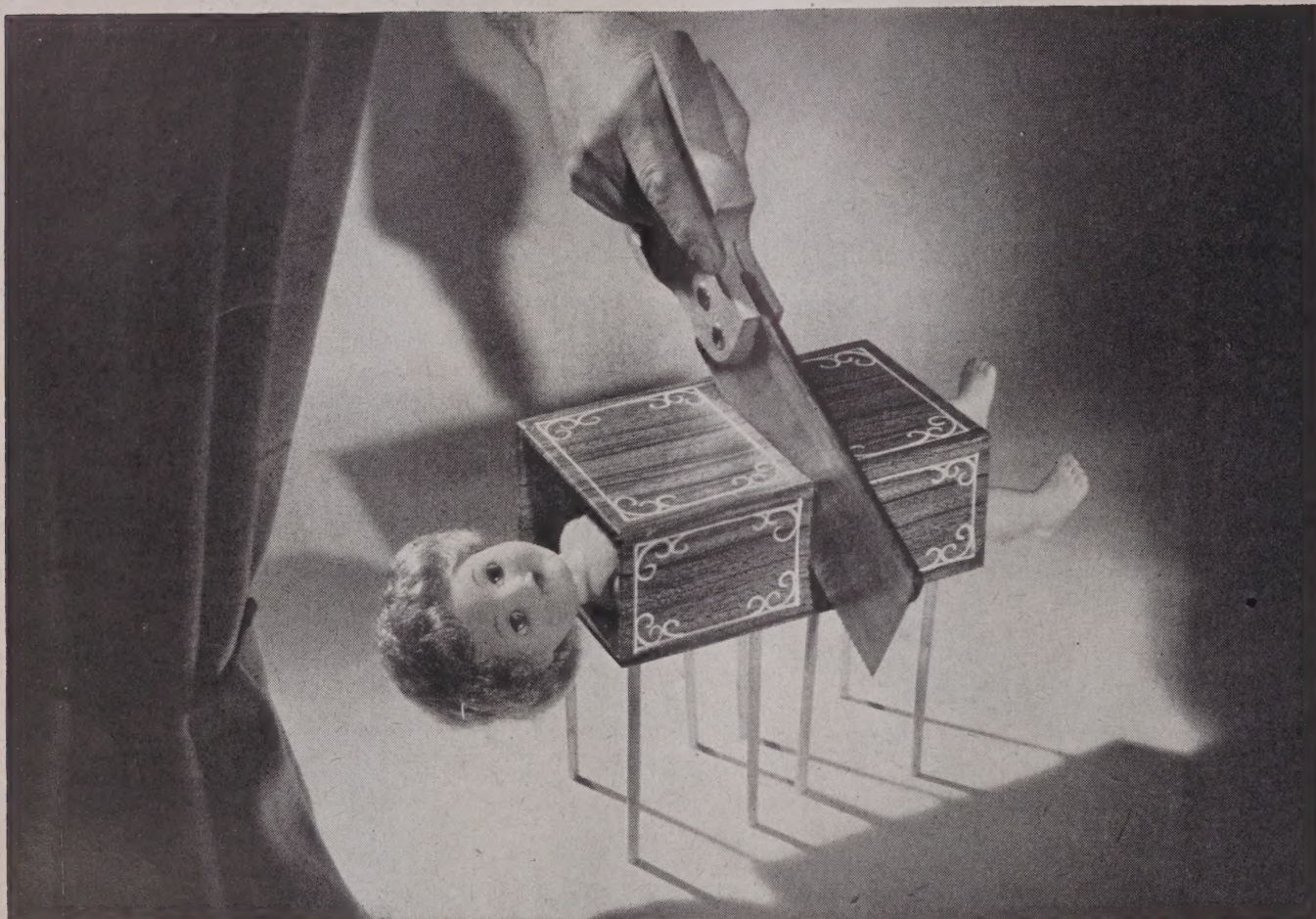
Telephone: PENDLETON 4373

**SALFORD 6**

Telegrams: VOLEXPROD, Salford 6



## When seeing must be believing



Measuring instruments are made to be seen *and believed*. They must be seen on occasions when the attention is half-focused or even distracted. And they must advise with hair's-breadth accuracy a state of affairs which may be occurring at the speed of light a great distance away.

Accuracy, reliability and *readability* are the three acknowledged components of Pullin design.

## PULLIN FOR PRECISION

# M-I-P

### MEASURING INSTRUMENTS (PULLIN) LIMITED

Electrin Works, Winchester Street, London, W.3. ACOrn 4651 & 8801

London Showrooms:

Electrin House, 93-97 New Cavendish Street, London, W.1. LAngham 4551-6



*33-kV 1000-MVA, compound-filled, metalclad switchboard*



## **POWER STATION SWITCHGEAR IN SOUTHERN RHODESIA**



*3 3-kV air-break circuit-breakers and a 480-volt auxiliary board*

*Consulting engineers  
Messrs. Merz and McLellan*

Reyrolle supplied the main and auxiliary switchgear and control equipment for No. 3 power station for the CITY OF SALISBURY Southern Rhodesia.

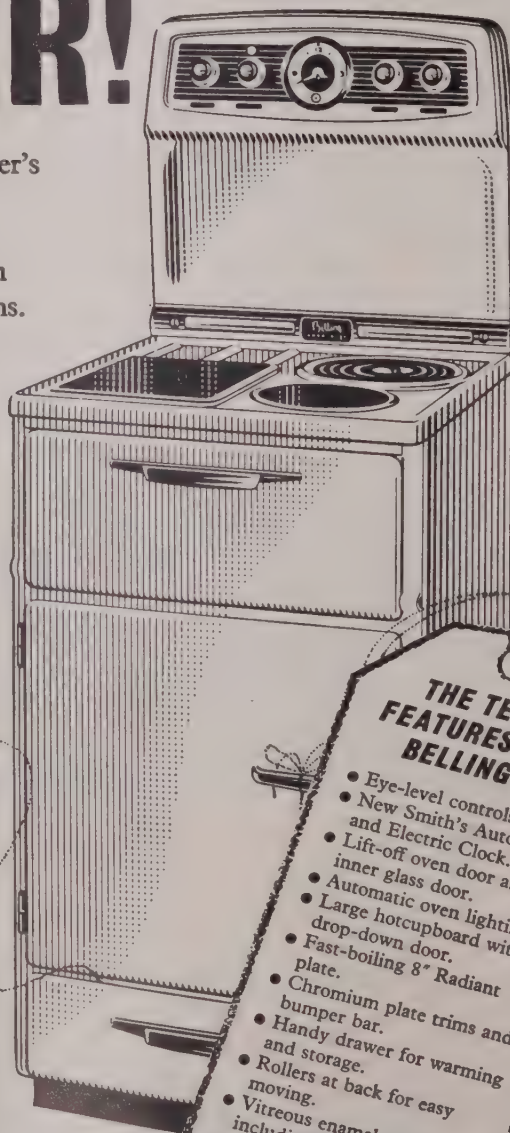
# **Reyrolle**





# It's the cooker for HER!

The Belling 48T is your customer's dream of a perfect cooker come true. We designed it after questioning thousands of women at exhibitions and demonstrations. It has been built to the highest specification, with a galaxy of easy-to-use and easy-to-clean features. So tell your customers about it and display it where it can speak for itself.



## AND FOR YOU TOO!

### NO ASSEMBLY NEEDED

Delivered complete with control panel already fitted and wired—no need for you to do any assembly work.

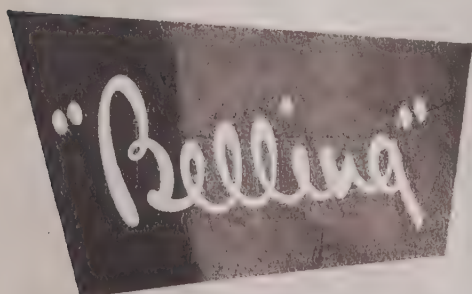
### EASY TO INSTALL

Simply remove the small inspection panel on the back to gain access to the mains terminals. No need at all to remove back or sides.

EXCLUSIVE  
REMOVABLE  
OVEN ROOF  
AND LINING

### THE TEN TOP FEATURES OF THE BELLING 48T

- Eye-level controls.
- New Smith's Auto-timer and Electric Clock.
- Lift-off oven door and inner glass door.
- Automatic oven lighting.
- Large hotcupboard with drop-down door.
- Fast-boiling 8" Radiant plate.
- Chromium plate trims and bumper bar.
- Handy drawer for warming and storage.
- Rollers at back for easy moving.
- Vitreous enamel throughout including hob, door panels and side panels.



# 48T AUTO-TIMER COOKER £51

48AB without Auto-timer £45. 15. 0

BELLING & CO. LTD., ENFIELD, MIDDLESEX, ENGLAND

CRC 476





**Variac**  
Reg. Trade Mark

*the  
original  
continuously-adjustable  
autotransformer*

*with the  
Exclusive*

**Duratrak**  
Reg. Trade Mark, PAT. 493406  
*Contact Surface*

This model, rated at 4.2 kVA, gives a voltage range of 0-270 volts at 15/17.5 amperes from a 240-volt supply.

A compact design weighing only 50 lb., it can be supplied in open form for panel mounting, ganged, motorised and oil immersed when required.

May we send our Catalogue VAR.5 giving further details of this and many other models?



Model 'V30-HM'

## THE ZENITH ELECTRIC COMPANY LTD.

ZENITH WORKS, VILLIERS ROAD, WILLESDEN GREEN, LONDON, N.W.2  
Telephone: WILlesden 6581-5      Telegrams: Voltaohm, Norphone, London

MANUFACTURERS OF ELECTRICAL EQUIPMENT INCLUDING RADIO AND TELEVISION COMPONENTS

# MUDIE'S *Industrial Switchgear*



Duplicate Bus-Bar Distribution Switchboard with flush mounting change-over switch fuse units.



**MUDIE'S ELECTRICAL CO. LTD., BIRMINGHAM 28**





Quality of the Expert, Skater

(Photo Swiss Tourist Office)

# CRYSELCO

lamps and fittings can be obtained from any of fourteen branches and depots throughout the country.

All CRYSELCO business is based upon a policy of Quality and Service.

This attention to detail in production and distribution, coupled with more than 60 years' experience in lamp manufacture, ensures quality products, promptly delivered.

The range of lamps and fittings available is extensive. If you have not received the current catalogue, please send for one today.

## QUALITY and SERVICE

**CRYSELCO BRANCHES** are situated throughout the country.

Their aim is to give you quality products plus good service.

CRYSELCO Managers in the following towns and cities would be pleased to hear from you.

**BEDFORD  
BIRMINGHAM  
BRISTOL  
BURY ST EDMUNDS  
CARDIFF  
GLASGOW  
LEEDS  
LEICESTER  
LIVERPOOL  
LONDON  
MANCHESTER  
NEWCASTLE  
NOTTINGHAM  
SOUTHAMPTON**



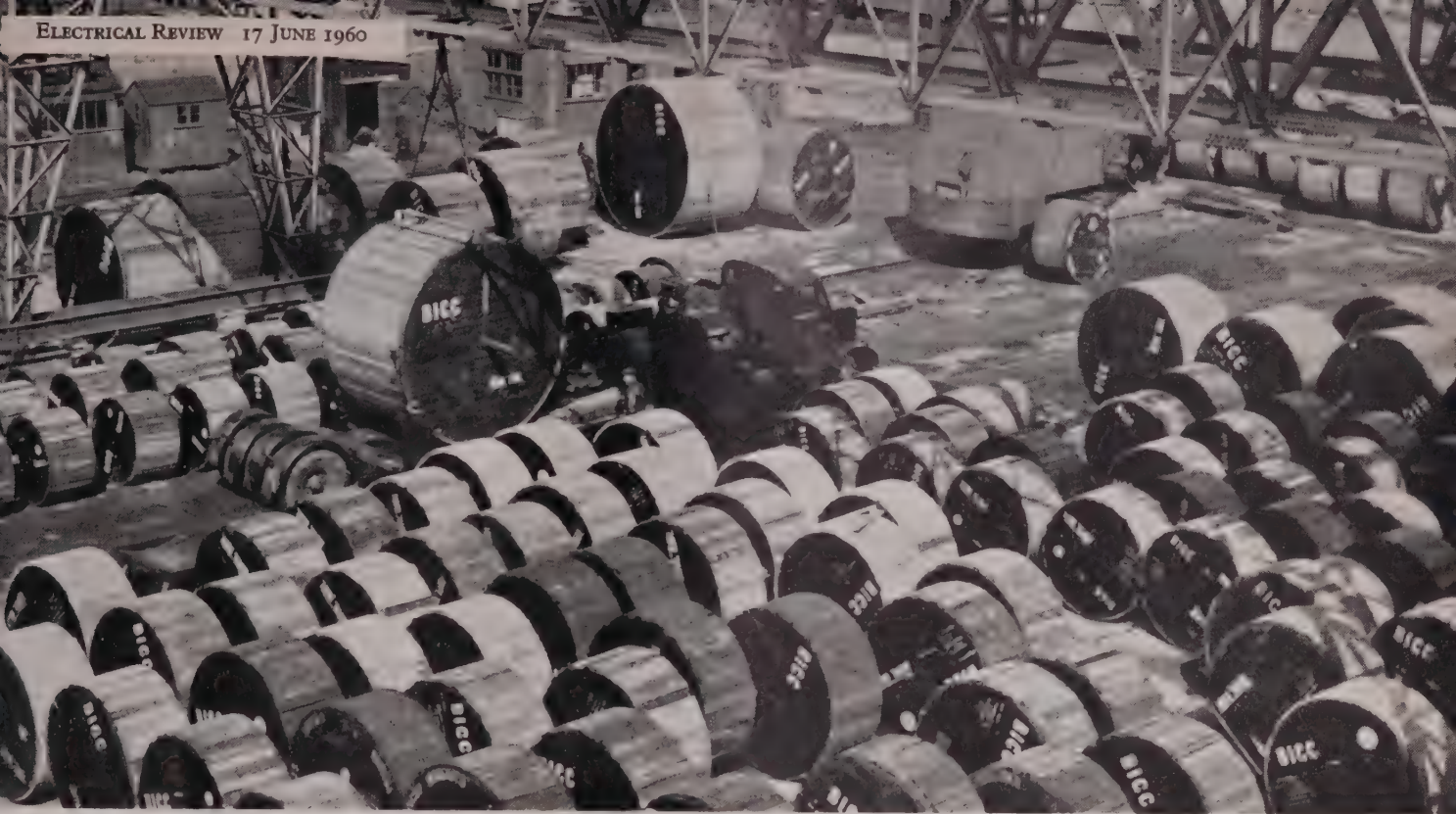
**CRYSELCO LIMITED**  
**KEMPSTON WORKS** **BEDFORD**



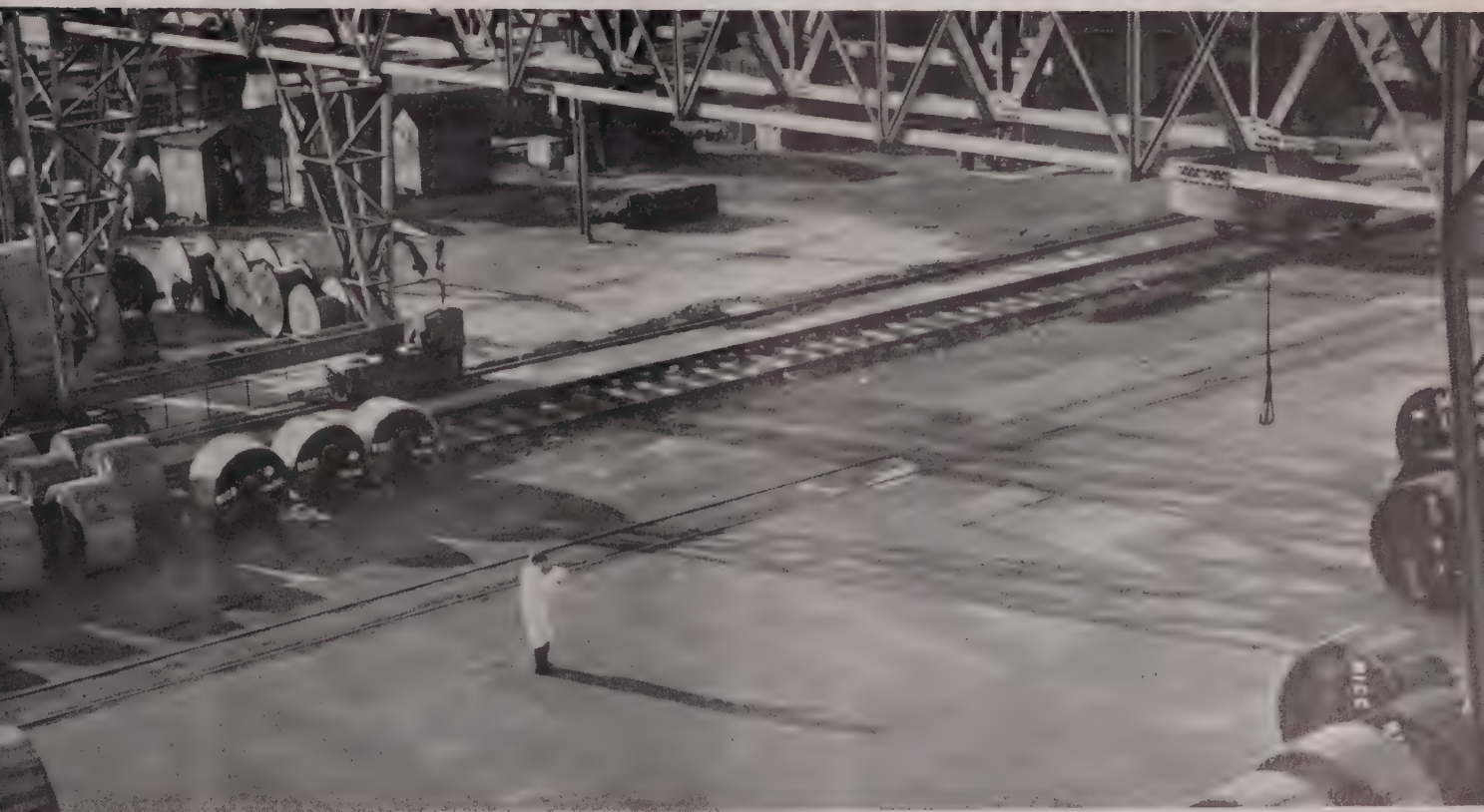
Service by Cable Car

(Photo Swiss Tourist Office)





**stock cables from Erith come faster!**



A 25 ton travelling crane keeps orders on the move at our Erith drum yard. We hold large stocks of standard cable—ready for cutting and delivery to you within forty-eight hours.

*today's stock orders . . . get moving today*

**BICC**

**POWER CABLES DIVISION**

ERITH WORKS · BELVEDERE · KENT



Sifbronze Welds are Good Welds!  
Whether for low-temperature welding or for full fusion  
welding, there is a 33-rod range covering  
every class of gas-welding operation.  
Quality counts, and Sifbronze rods are first-  
quality rods and are  
made to BSS 1453 and BSS 2901.

*If you are not using  
Sifbronze, write now for full details.*

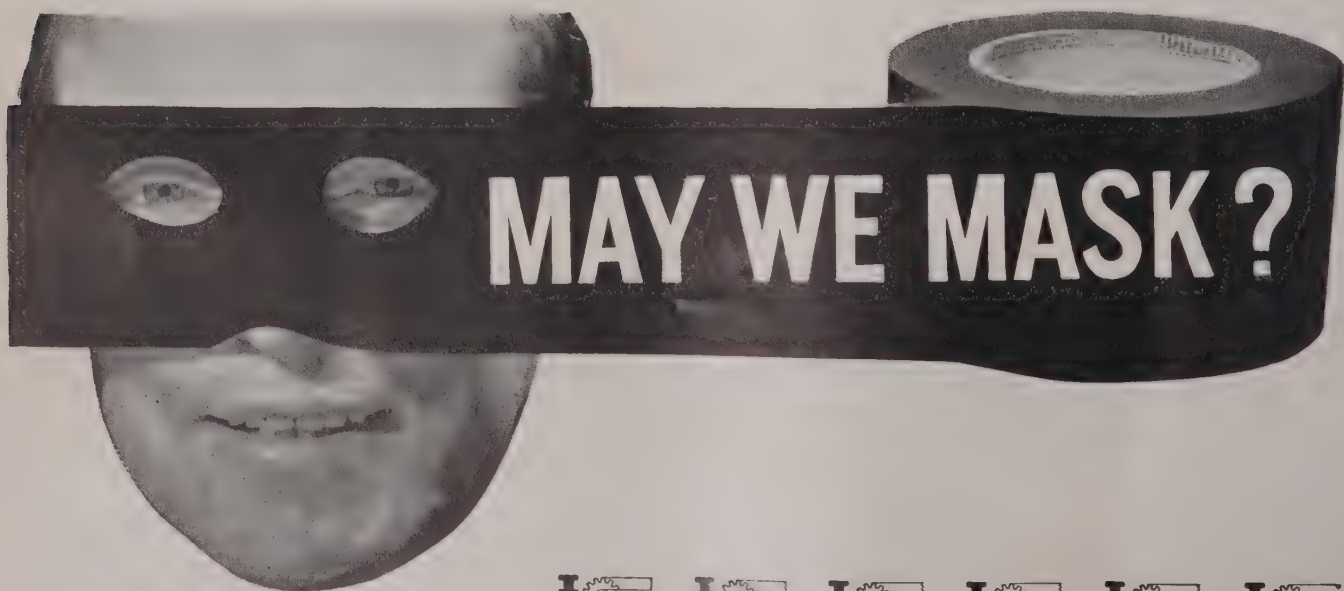


# SIFBRONZE WELDS STAY WELDED!

SUFFOLK IRON FOUNDRY (1920) LTD., STOWMARKET, SUFFOLK



says Will the Welder

ER/11




Can we help you with your masking requirements? Whether the surface be concave, convex, plain or complex our Masking Tapes do a good job.

They are designed to meet the requirements of every type of industrial process. Send in the coupon below. We shall be happy to advise you.





**TO: INDUSTRIAL TAPES LTD., SPEEDFIX HOUSE,**  
 19-23 FEATHERSTONE STREET, LONDON, E.C.1. CLE 6881

NAME ..... COMPANY NAME .....

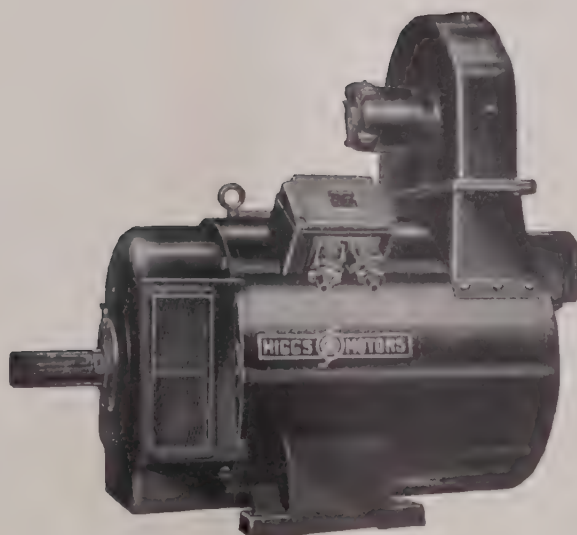
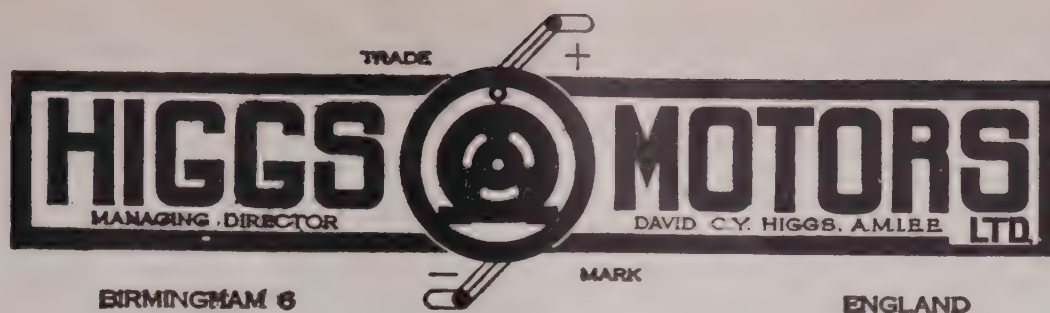
ADDRESS .....

Please advise, without obligation, on the following problem.....

.....

TEMPERATURE RANGE..... DURATION OF PROCESS.....  
 (E.R.) ..... (TT/20)





## VARIABLE SPEED THREE PHASE MOTORS

with

INFINITELY FINE SPEED VARIATION

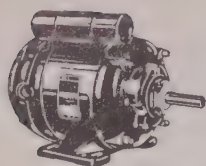
for an

INFINITE VARIETY OF DRIVES

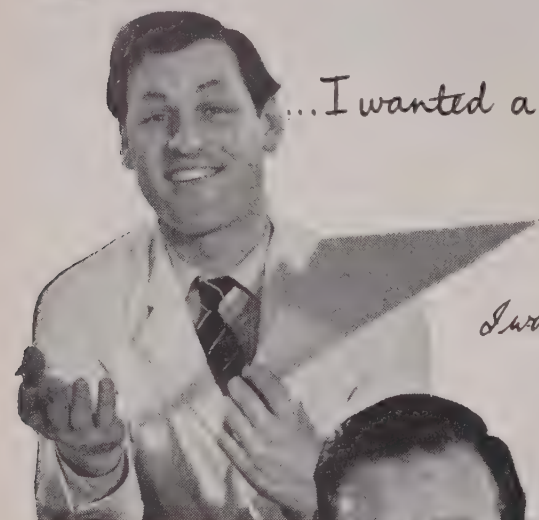
**GUARANTEED FOR EVER**

**AGENTS AND BRANCHES COVER THE WORLD**





## THEY ALL CHOSE AEI FRACTIONALS



*...I wanted a shaded-pole motor*

*I wanted a quiet running motor...*



*...I wanted a 'fractional' with  
automatic reset  
thermal overload protection*



Whatever the project, if you are producing machinery to be powered by a.c. or d.c. motors of up to one h.p., consult AEI engineers at the design stage. The wide choice of fractionals they can offer gives you greater scope for producing machinery of improved design and performance. AEI experts have almost certainly met problems similar to yours already, and their valuable experience and knowledge are at your service.

### OUR ADVISORY SERVICE FOR DESIGNERS

*will save you time and trouble!*

Consult AEI engineers at an early stage and make sure of getting the right f.h.p. motor for the job! Many types and sizes from 1/500 h.p. are available, with every conceivable kind of mounting or fitting, and many of these are available from stock. You can thus combine maximum efficiency and reliability with the most compact, practical, and attractive design.



**Associated Electrical Industries Limited**  
**Motor and Control Gear Division**

F.H.P. MACHINES SALES

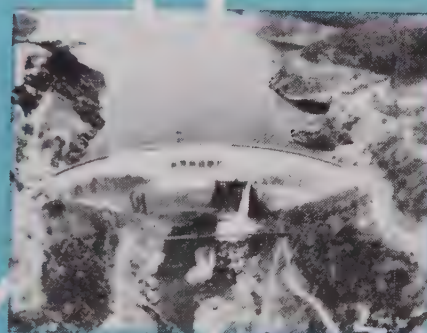
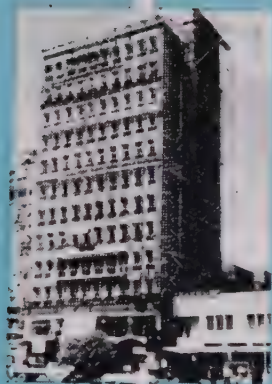
NEWCASTLE, STAFFORDSHIRE, ENGLAND



INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V







1910

1960

**CLOUGH, SMITH & COMPANY LIMITED**

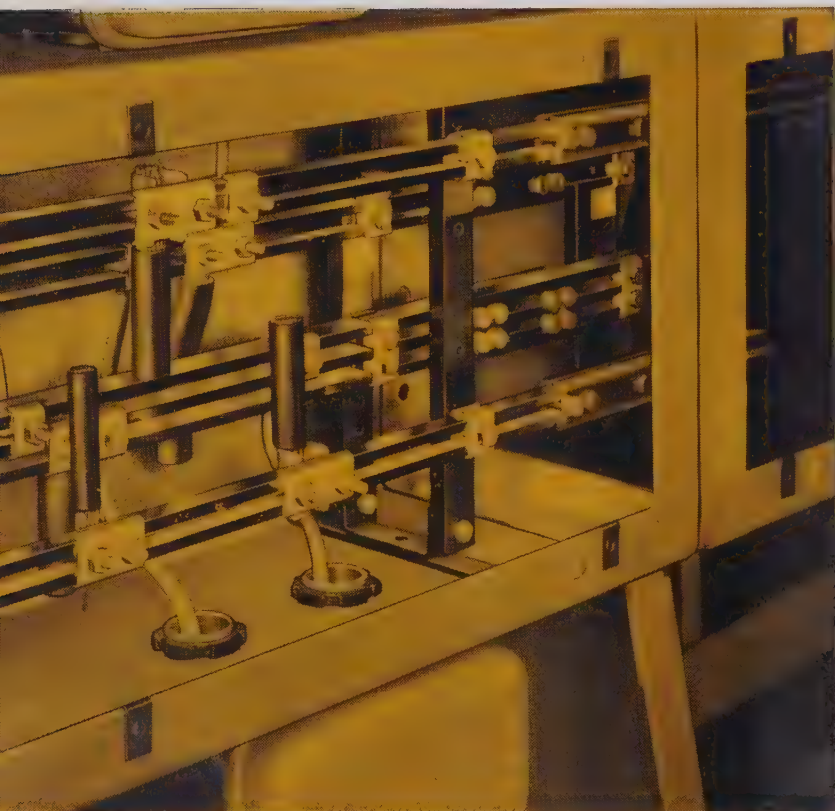
*Fifty Years of Development in Electrical Contracting*

STEPHENSON WAY · CRAWLEY · SUSSEX · TELEPHONE: CRAWLEY 26151



# Simplex Star

## BUSBAR CHAMBERS WITH STAR FEATURES

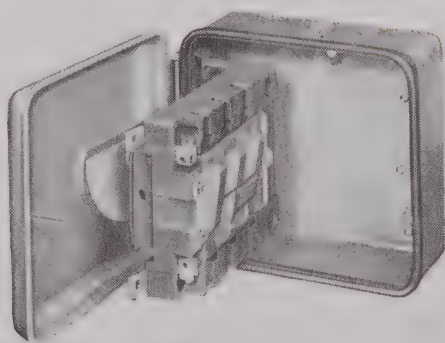


- ★ Smart and modern in appearance.
- ★ Simple and sound common-sense wiring facilities.
- ★ Phase indication.
- ★ Universal clamp connections that require no drilling and no sweating.
- ★ Maximum adaptability of stand assemblies, length of chamber, and polarity.
- ★ Detachable busbar supports that can be repositioned to suit incoming and outgoing feeds.

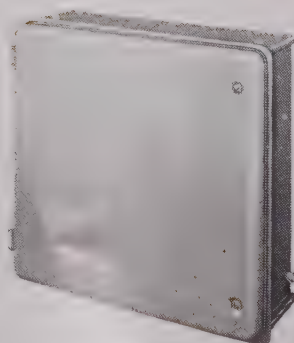
Send or 'phone for fully descriptive leaflet.

Close up of interior of Star Busbar Chamber showing busbar arrangement, and main and branch terminals. Cables, deliberately cut away for purpose of illustration, are 15 and 3 sq. in. sizes.

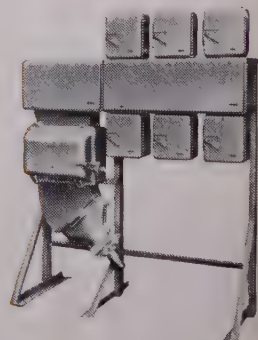
The new Simplex Star range of switchgear has already become big-news. Here is an example of advanced thinking, of improved design and modern methods that add a plus to every feature yet a minus to the price.



Star switchfuse with cover open showing interior hinged forward for ease of wiring.



Star fuseboard.



Star switchboard—A team of Simplex practical experts will help you with designing building and advice on complete Simplex switchboard installation.



# **Busbar Chambers from this brilliant new range of dead-front switchgear with every- thing plus but the price**



**The Simplex Star range, simpler, smarter, more easily serviced, is a wide practical range, covering industrial and commercial applications or requirements. Wiring and assembly instructions are enclosed with all units together with list of spares.**

**SIMPLEX ELECTRIC COMPANY LIMITED**

BLYTHE BRIDGE, Nr. STOKE-ON-TRENT, STAFFS.

Branches throughout Great Britain and Agents throughout the World.



**a new range of inexpensive industrial  
and commercial fittings**

Here is G.E.C. reliability  
at budget prices.

This new Paragon range  
includes the popular  
Osram 1 x 80w pack  
at £4.19.8.

All patterns are  
cartoned complete  
with Osram guaranteed  
warm white tubes,  
and available one  
or two light.

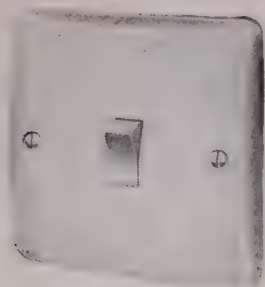


# paragon

ECONOMY RANGE OF FLUORESCENT LIGHTING FITTINGS including the **Osram** 80W PACKS







**elegant...**

Accepted by the Council of  
Industrial Design for  
"Design Index"



**efficient...**

**CONTACTUM**

**SEE-SAW**

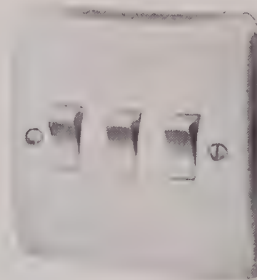
### Rocker Dolly Flush Switches

5 amp. 250 volt A.C. In Brown or White Bakelite.

One, two or three switches mounted on a single plate to fit a wood or steel plaster-depth box or B.S. 1299 steel box.

Single Pole switches. Short slow make-and-break type with exceptionally smooth action. Silver faced contacts.

Incorporating all the features demanded by competitive housing schemes.



**modern...**

**MAKE CONTACT WITH CONTACTUM**

*Write for illustrated leaflet and prices*

**CONTACTUM LTD.**

VICTORIA WORKS, EDGWARE ROAD, LONDON, N.W.2

(Phone and Grams : GLAdstone 6366-7)



Established 1760

*Congratulations to  
George Salter & Company Ltd.  
on the achievement of their Bi-Centenary*

### PHOSPHOR BRONZE AND COPPER WIRE, BAR, AND STRIP

For Springs manufactured by George Salter & Co. Ltd.  
for the Electrical Industry, supplied by

**THOMAS BOLTON & SONS LTD.**

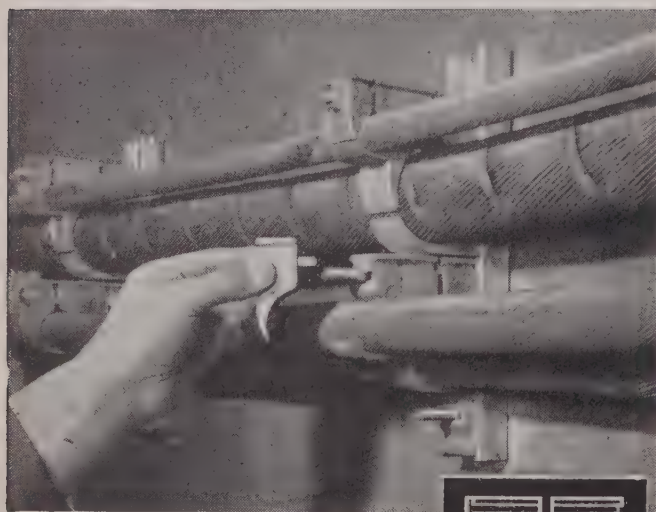
Head Office: Mersey Copper Works, Widnes, Lancs. Telephone: Widnes 2022  
London Office & Export Sales Dept.: 168 Regent St., W.1. Tel.: REGent 6427



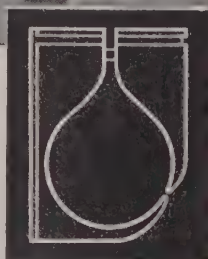
Established 1783



# Contractors are cutting costs with **CS** Cable Supports



The CS hook section supports the cable during installation, leaving the hands free for fixing. Note the extremely neat appearance of the CS installation.



## UNIQUE HOOK SECTION ELIMINATES MANUAL HOLDING

Many important new buildings are installing cables with the new CS cable support system, a notable example being St. Christopher House, Southwark Street, London. As is clearly shown in the illustration the unique hook section eliminates manual holding of the cable during fixing. A universal channel section simplifies adaptation vertically and horizontally. All components are in aluminium alloy to British Standard 1490 and 1476 specially selected to give maximum resistance to corrosion. Sizes cater for cables  $\frac{1}{2}$ " to 3" diameter. Careful design has combined good appearance with economy. The CS system actually costs less than any other system of comparable quality, yet has many unique advantages.

Write for detailed information and prices to

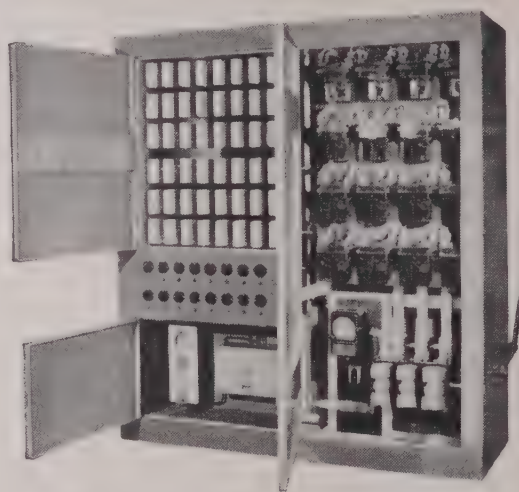
**CABLE SUPPORTS LIMITED**

301 BRIXTON ROAD · LONDON · S.W.9

Telephone: Brixton 1103

# BKS

## Heating Control Panels *built to individual Specifications*



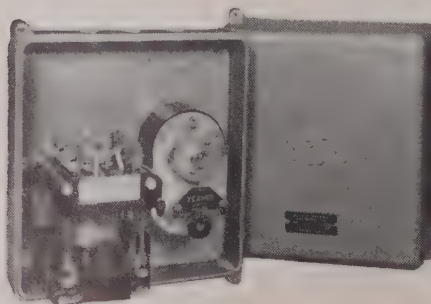
### THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities, the overall costs of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 K.W.

The panel illustrated handles 267 K.W. and is divided into 16 zones with individual limit thermostats and overall control by time switch; together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.

### CONTACTORS

- Comprehensive range of contactors for all types of thermal storage and space heating control — 10 to 350 amp. SINGLE, DOUBLE, TRIPLE AND FOUR POLE.
- FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.



Triple pole 30 amp. Contactor with Time Switch type MD1SP

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Telephone: Chertsey 3467

Telegrams: Switchgear, Chertsey

Branches at Manchester, Glasgow, Newcastle, Midlands and Eire  
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To **BRITISH KLOCKNER SWITCHGEAR LTD., CHERTSEY, SURREY**

Please send me your list of Contactors for Heating Control

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POSITION \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

ERJ17/6/60



## ELLISON FUSE-SWITCHGEAR

# Can **you** take it easy?

Stoppages of plant can be a very costly business, affecting operators, works engineers and production managers.

If the plant is properly protected by good, reliable switchgear, however, stoppages rarely occur. Ellison Fuse-switchgear, for example, can make life much easier for all concerned. Designed and built to B.S. 3185:1959, it will operate for long periods with little or no maintenance.

No switchgear should be neglected but, rest assured, you can take it much easier with Ellison Fuse-switchgear.

*May we send you further information?*

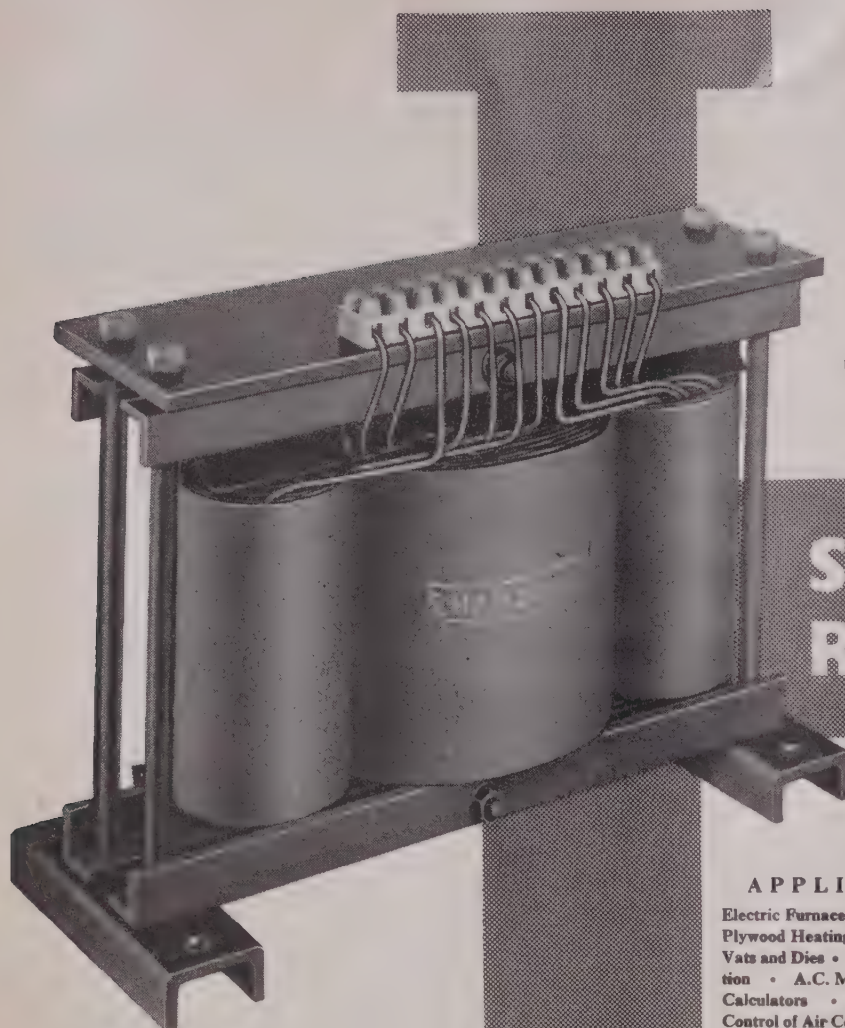


**GEORGE ELLISON**  
LIMITED

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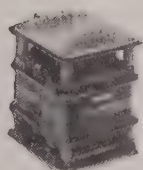


Open or  
enclosed  
construction  
up to 500 kVA

## SATURABLE REACTORS

### APPLICATIONS

Electric Furnaces • Servo Mechanisms  
Plywood Heating • Plastic Extrusion  
Vats and Dies • A.C. Voltage Stabilisation  
• A.C. Motors • Computers  
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**C-CORE OPEN**  
or  
Hermetically Sealed  
up to 1600 VA

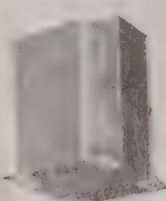


**SERIES 7002**  
Transformer/Chokes  
5 VA to 1500 VA

### OTHER TRANSFORMERS FROM THE HADDON RANGE



**3-PHASE**  
Power Transformers  
up to 100 kVA



**SERIES 7003**  
Semi-Enclosed  
10 VA to 250 VA

Saturable Reactors are available, open or enclosed, air or oil cooled, in over 60 sizes, to control powers up to 500 kVA. They are ideal for the stepless control of AC circuits of high power.

**OUTSTANDING PERFORMANCE**— Example: The amount of DC power required is as little as 20W to control the Haddon 10 kVA saturable reactor output from 3% to 95% of its full AC load.

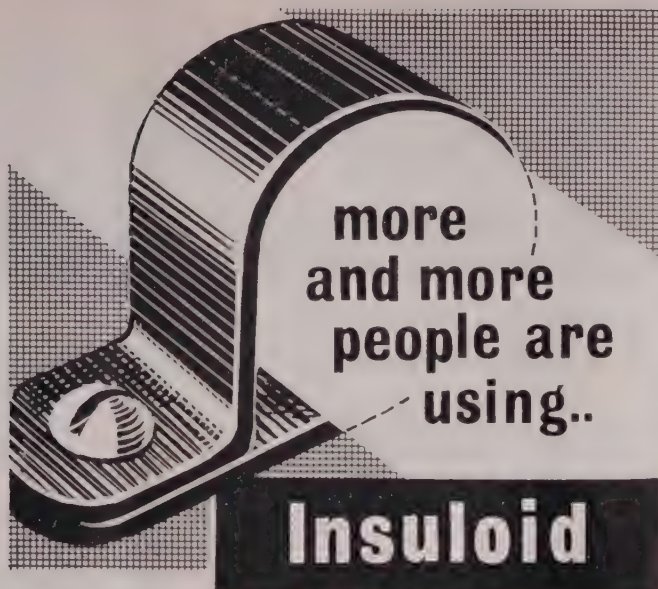
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**HADDON TRANSFORMERS LIMITED**

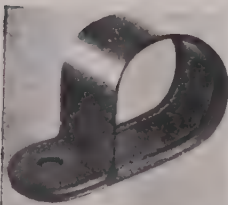
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FIELD END ROAD, RUISLIP, MIDDLESEX

Telephone: Byron 9444-8    Telegrams: Hadtrans, Ruislip





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NX CLIP

Made from the highest grade nylon, stronger than metal and twice as light, in sizes  $\frac{1}{8}$  in. to 1 in. inside diameters.



CY CLIP

For dual cable runs in seventeen sizes, covering cable diameters  $\frac{1}{8}$  in. up to  $\frac{1}{2}$  in. In highest grade hard P.V.C.



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Manufactured in highest grade hard P.V.C. in twenty-five different sizes from  $\frac{1}{8}$  in. inside diameter to 2 in. inside diameter to cover the smallest and largest wiring runs.

Send for fully descriptive literature covering a full range of Insuloid Cable Clips and Ring Lock Bushes today.

Wherever a high grade and secure fixing is required for cables, tubes or components, Insuloid Cable Clips will be found.

Every year more and more millions of Insuloid NX, CY and X type clips are supplied all over the world to Radio, Electronic, Switchgear, Domestic Appliances, Aircraft, Marine Engineering, Atomic Energy, Electrical Contracting, and Laboratory Equipment manufacturing industries.

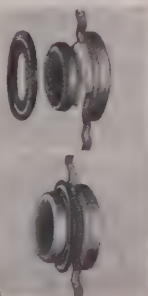
That's real proof of satisfaction and service in all climatic conditions.

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### RING LOCK BUSH

Here's a bush specially designed for instant assembly. The Insuloid simple snap-on finger action is as quick as a thought and once it's fixed it stays fixed, guaranteeing no chafing, and no tools are required whatsoever.

Insuloid Ring Lock Bush is non-metallic, fully tropical, high dielectric, is approved by all services and is completely secure under all working conditions. Another Insuloid time - and - money - saving component.



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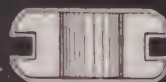
STEATITE  
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RUBBER



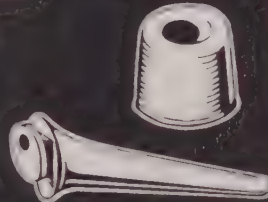
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## RUBBER GROMMETS METWAY



BUSHES  
ETC

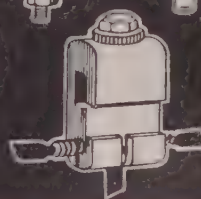
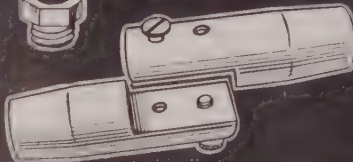
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## BRASS ACCESSORIES METWAY

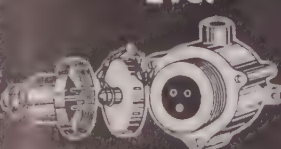
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WE SHALL BE PLEASED TO SEND THE ABOVE CATALOGUES

**METWAY - KEMP TOWN - BRIGHTON**





# QUICKWAY

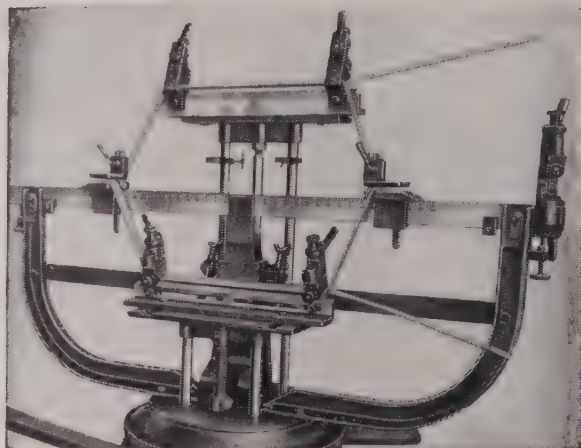
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coilwinding and forming machine is used by leading manufacturers and repairers of electrical equipment and produces a wide range of uniformly shaped armature and stator coils.

The standard machine produces formed coils up to 28in. loop length. Additional attachments can increase the range up to 42in. loop length.

Also available in the 'QUICKWAY' range are armature winding and taping machines.

**Coil winding and forming machines**



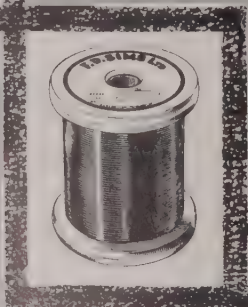
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**THE MIDLAND DYNAMO CO. LTD.**

QUICKWAY WORKS, LEICESTER - Tel. 20172 (5 lines) - Grams: 'DYNAMO' LEICESTER

**"SIMS 155"**  
(POLYESTER)

**Covered  
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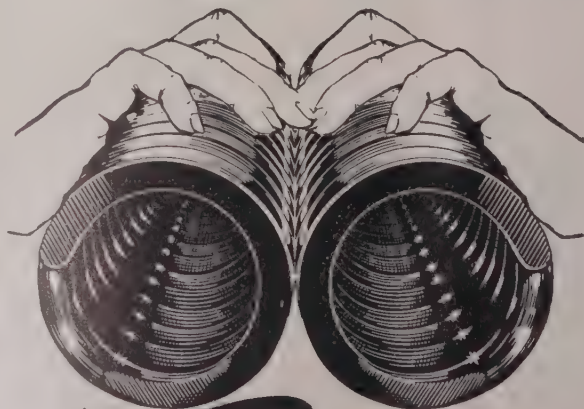
106 Newlands Park, Sydenham London S.E.25

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S48



**Looking in the  
right direction**



**Ratcliffe**

**SPRINGS**

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A.C. & D.C. MOTORS OF ALL TYPES  
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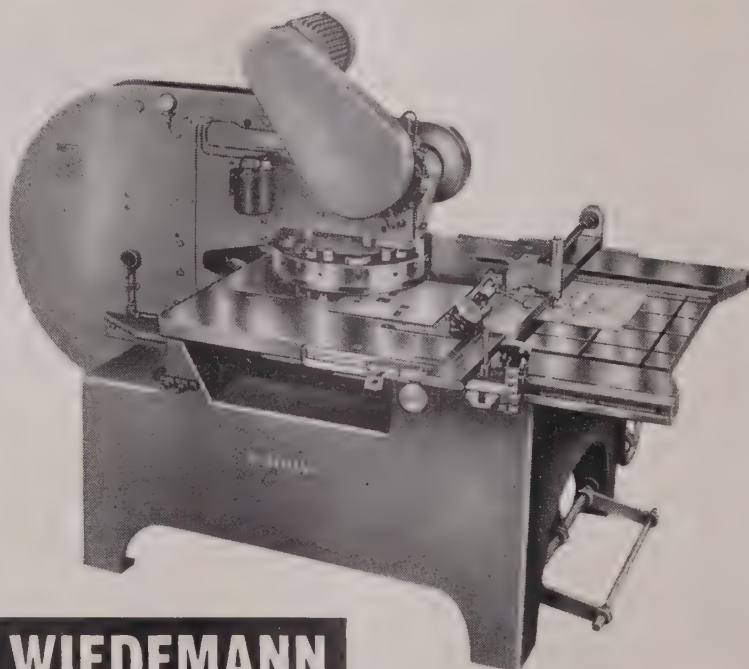
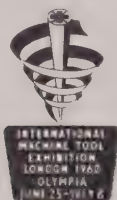


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## TURRET PUNCH PRESS MODEL RA.41P

Locating from templates by pantograph table and stylus, this model is exceedingly fast on the longer piercing runs. All template holes are  $\frac{1}{4}$ " dia. irrespective of their size and shape in the finished work. Template holes for all similar work openings are connected by coloured 'routes'; following each 'route' the operator engages the stylus in each successive template hole. As the stylus moves the work follows and on depressing the stylus the press trips. Templates themselves can be made on the machine. Up to 3" dia. can be pierced in .074" mild steel plate.

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*16 Turret stations. Also available with 18 or 20 stations.*

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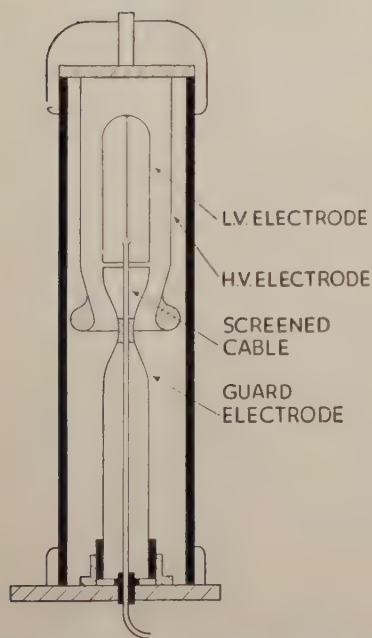


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The Bushing Co. Ltd. manufactures a range of compressed gas capacitors intended for use as comparison standards for the measurement of capacitance and dielectric loss factor. The capacitors are constant in value and virtually loss-free.

The gaseous insulant is dry, oxygen-free nitrogen at a pressure of 10 atmospheres and freedom from losses and invariance of capacity is ensured by the design and screening of the electrodes.

*The sizes available are 50kV, 150kV, 200kV, 300kV and 500kV both 50pF and 100pF capacitors are available in each size.*



**THE BUSHING COMPANY LTD.**  
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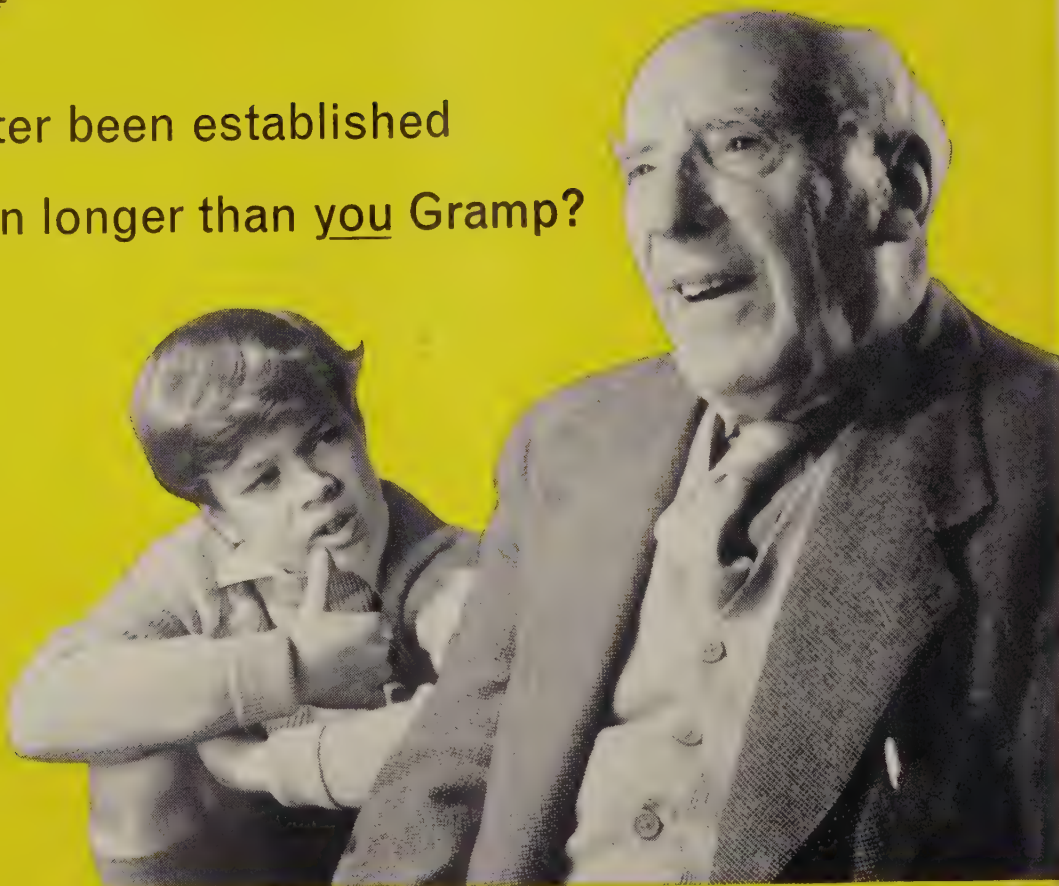
Grams: "BUSHING HEBBURN"



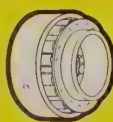




Have Salter been established  
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Age alone has little to commend it  
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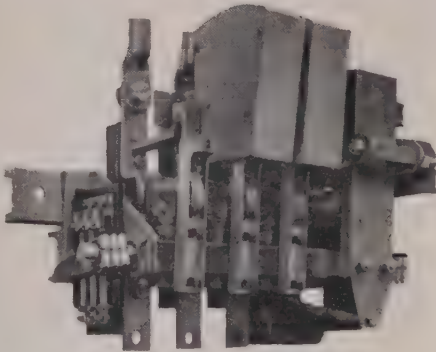
OF WEST BROMWICH THE TWO CENTURIES-OLD COMPANY WITH TOMORROW IN MIND



## ENBRAY UNIT TYPE HEAVY DUTY CONTACTORS

Types M & N  
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- Bounce-free
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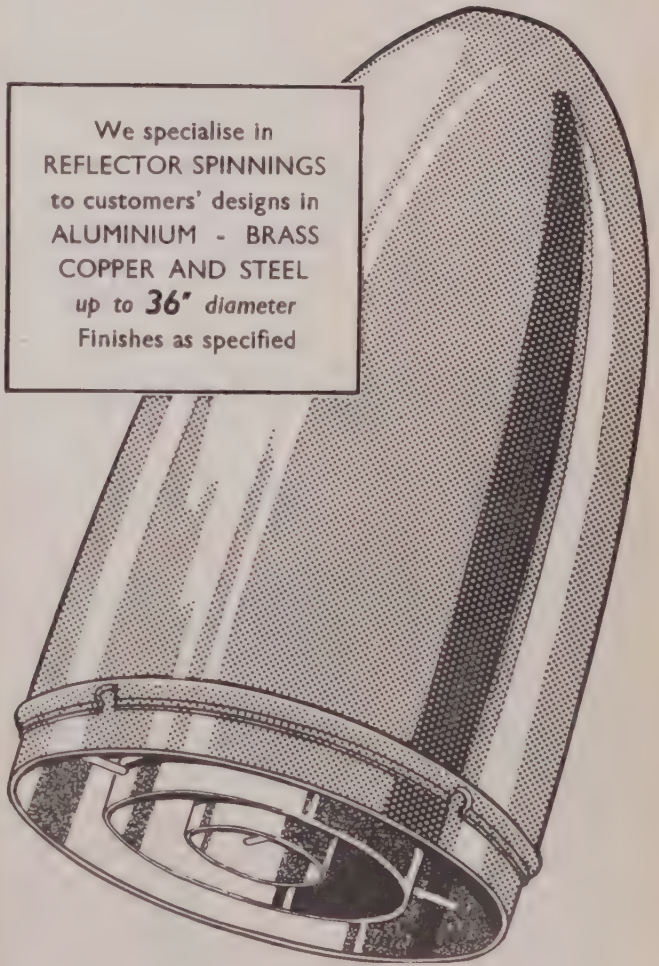
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## STOCKFIELD

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# "ELMO"

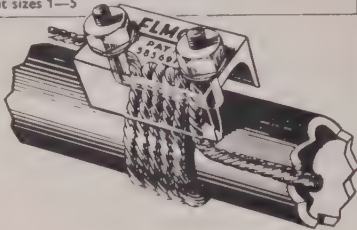
## EARTHING CLAMPS

A COMPLETE RANGE TO B.S.951. 1948  
IN 4 SIZES

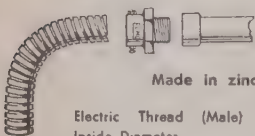
	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes	1, 2 & 3	4 & 5	6 & 7	8, 9 & 10
i.e. in trade terms	$\frac{1}{2}$ " to $\frac{3}{4}$ "	1" and $1\frac{1}{4}$ "	$1\frac{1}{2}$ " and 2"	$2\frac{1}{4}$ " to $3\frac{1}{2}$ "

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5

"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.



## ELECTRICAL FITTINGS



### Flexible-to-rigid CONDUIT COUPLINGS

Made in zinc base alloy in the following sizes:

Electric Thread (Male)  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"

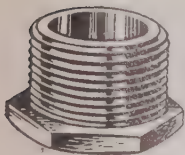
Inside Diameter  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"

Electric Thread (Male)  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"

Inside Diameter Flexible Conduit  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"

### WITH EARTHING TERMINAL

Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal Threads suit all makes of flexible tubing.



MALE  
Hex. Section

### CONDUIT BUSHES

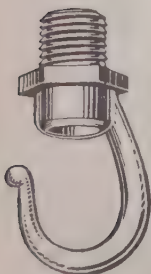
Made in the following sizes:

MALE: Electric Thread  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"

FEMALE: Electric Thread  $\frac{1}{8}$ "  $\frac{1}{4}$ "  $\frac{1}{2}$ "  $\frac{3}{4}$ " 1" 1 $\frac{1}{2}$ " 2"



FEMALE  
Flat Face Section for  
Spanner (except  $\frac{3}{8}$ "  
size, which is round)



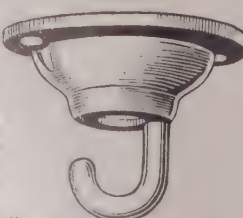
### CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed 2" thread, male electric.

Made to fixed standard sizes with two sizes 7/16" diameter—2" centre diametrically opposed. 1/2" hole in base and with 3/16" dia. hole. Specification.

Both made to aluminium alloy

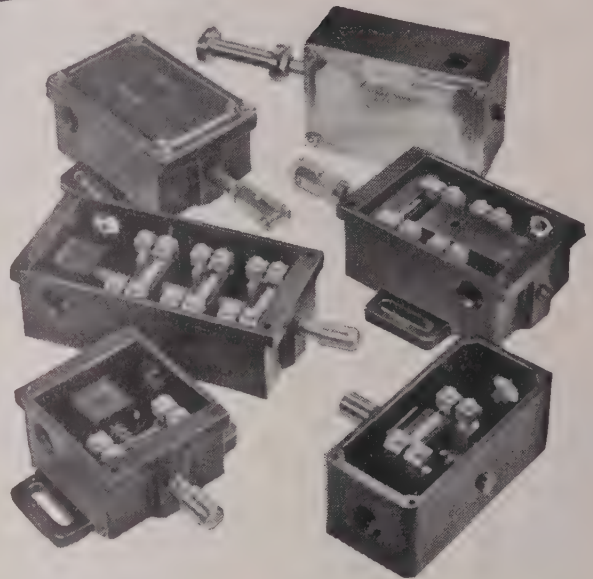
### CEILING PLATE One hook



Manufactured by M. MOLE & SON LTD.  
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# "Colne"

## HEAVY DUTY LIMIT SWITCHES



Manufactured by

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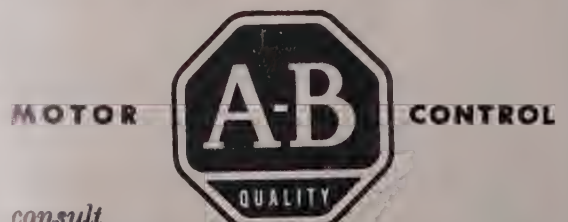
Walton Street, Colne, Lancs.

Telephone: Colne 1394/5

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CONDUITS & FITTINGS

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# copper strip



## ROLLED STRIP

Cold rolled strip is available over a wide range of thicknesses and widths.

Rolled strip can be supplied soft, half hard or hard.

Thicknesses are from 0.002" upwards and widths up to 5½".

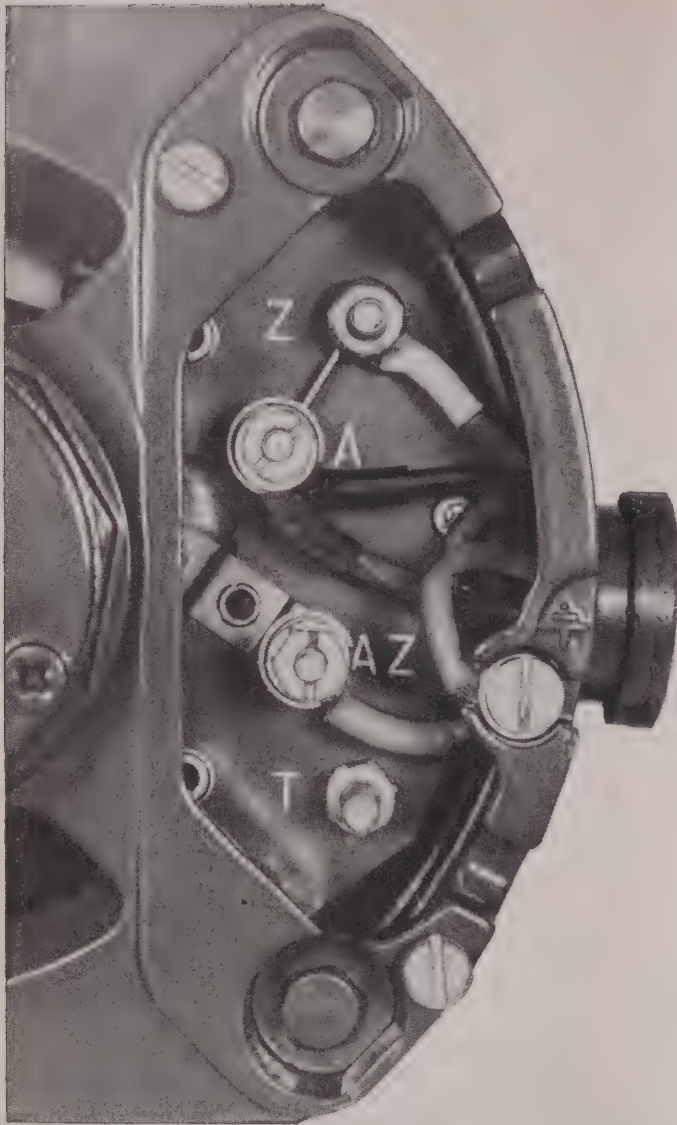


*Test gauging copper strip*

FREDERICK SMITH & COMPANY ANACONDA WORKS · SALFORD 3 · LANCs







DESIGNING



## AND MAKING F.H.P. MOTORS

Something important has been obscured by the success of the mathematical approach to design – that engineering is an art as well as a science. Not everything can be worked out: beyond a certain point – particularly on detail – the designer has to trust his eye, his feeling for a sound job or his imagination. But these, in turn, depend on experience, not his alone; the common stock of the people he works with. This is the art; and it is the channel through which the accumulated experience of an engineering firm is fed back into new products.

The details in which it shows up sometimes seem trivial in themselves, but in aggregate they are important. A very simple example is the terminal box on our new F.H.P. motors. It is unusually large and the terminals are far bigger than the current that they carry would require. As a result, the motor is exceptionally quick and easy to connect up. Why, then, do not all small motors have large terminal boxes? Well, room has to be found on a small end-cover for a thermatrip, a bearing with a generous oil well and ventilation openings. Our designers have fitted them all in so successfully that there appears to have been no problem. It looks simpler than it is . . . which is often the way with good design.



**Crompton Parkinson** LIMITED

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.



**REAL**

## Watertight Protection

Come hail, rain or shine, R.E.A.L. Non-Corrosive Watertight Fittings stand the test of time in any part of the world. There just isn't anywhere in this all-porcelain one-piece fitting where rain or damp of any kind can do damage. Incidentally, it's a matter of seconds to unscrew the well glass to fit a replacement lamp. This is R.E.A.L. saving in time, money and maintenance!

*with***REAL**

## Watertight Fittings

R.E.A.L. is the registered trade mark of  
ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. Works, Birmingham, 18



Patent No. 568702

Catalogue No.  
P5806 gives details  
of all sizes from  
60 watt to 500 watt.

## BATTERY CHARGERS

HEAYBERD Battery Chargers, incorporating metal rectifiers, embody the results of more than 25 years' experimental work and the understanding of customers' special requirements.

List No. 1048 describes over thirty different types of Battery Chargers.

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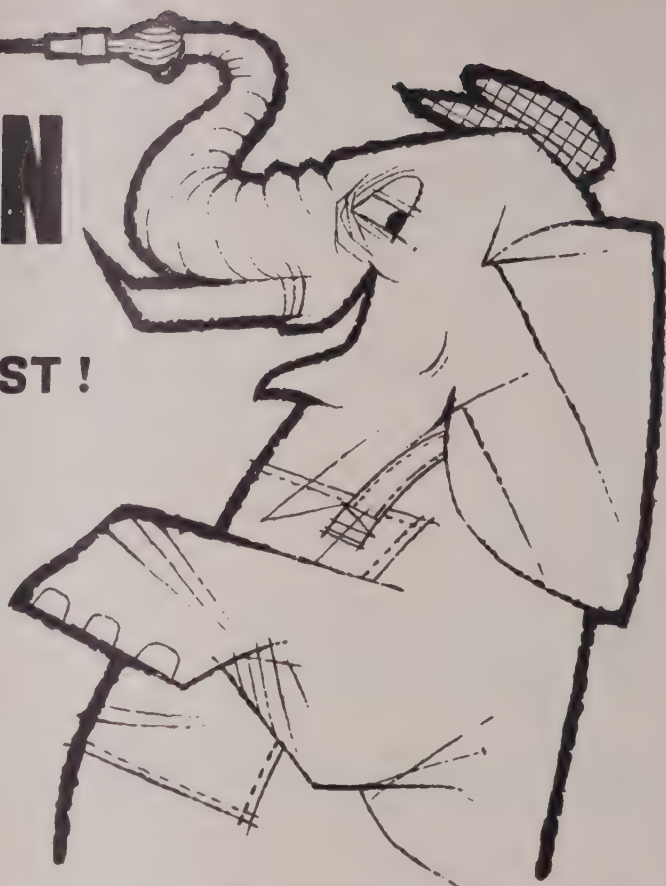
# NEVER FORGET

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Architect: Gwynn, Melvin, Ward and Partners

... in the new library at Sheffield University

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LONDON ELECTRIC FIRM LTD. have solved many difficult problems involving maintenance of lighting in all types of building and in street systems throughout the country. Discuss *your* problem with them, they will be glad to advise you.



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# all the cable at Hunterston

is **pg**

19,500 yards of Pirelli-General 132 kV. single-core oil-filled cable are being installed between the transformers at the power station and switching station. The insulation of this cable is designed for 110 kV/cm. maximum working stress.

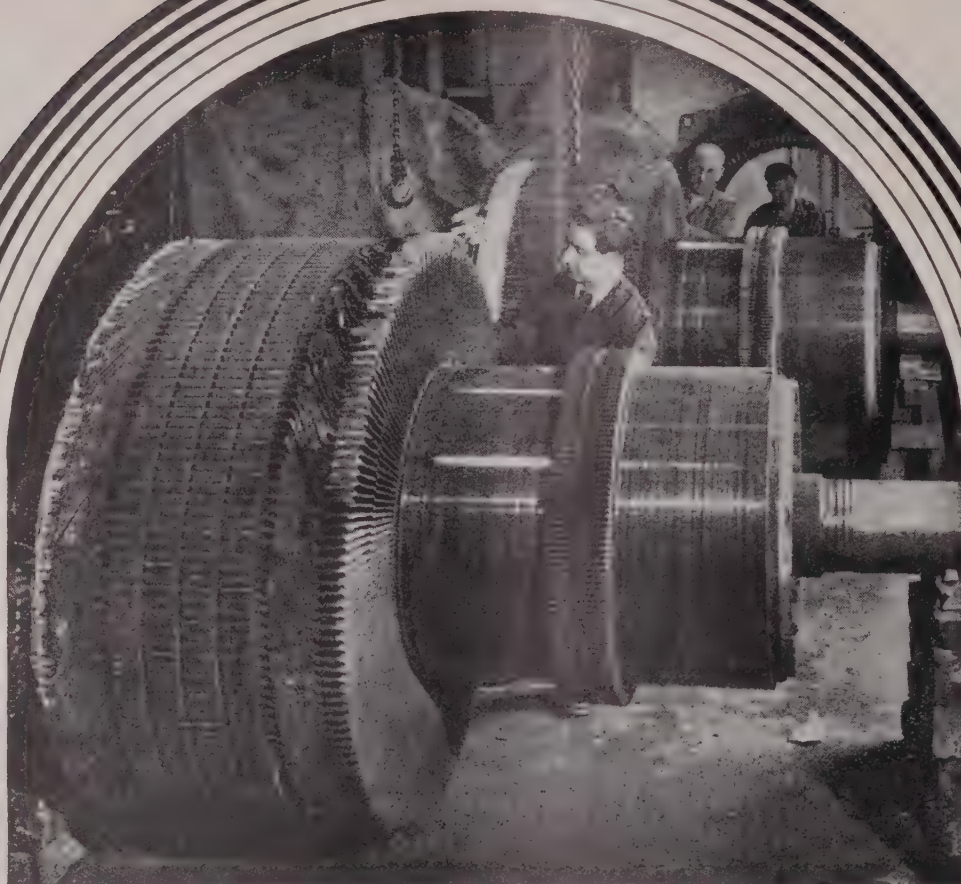
With the completion of this installation the whole of the cabling at Hunterston will have been carried out by Pirelli-General.

Hunterston is being constructed by the G.E.C.-Simon Carves Atomic Energy Group. Consulting Engineers to South of Scotland Electricity Board, Kennedy and Donkin.



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SOUTHAMPTON AND EASTLEIGH





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*Central London Works*

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that's all it takes to instal the new

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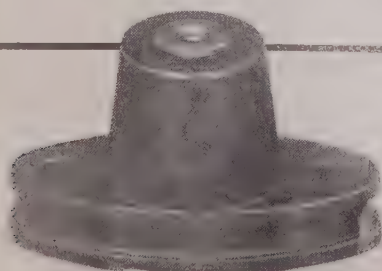


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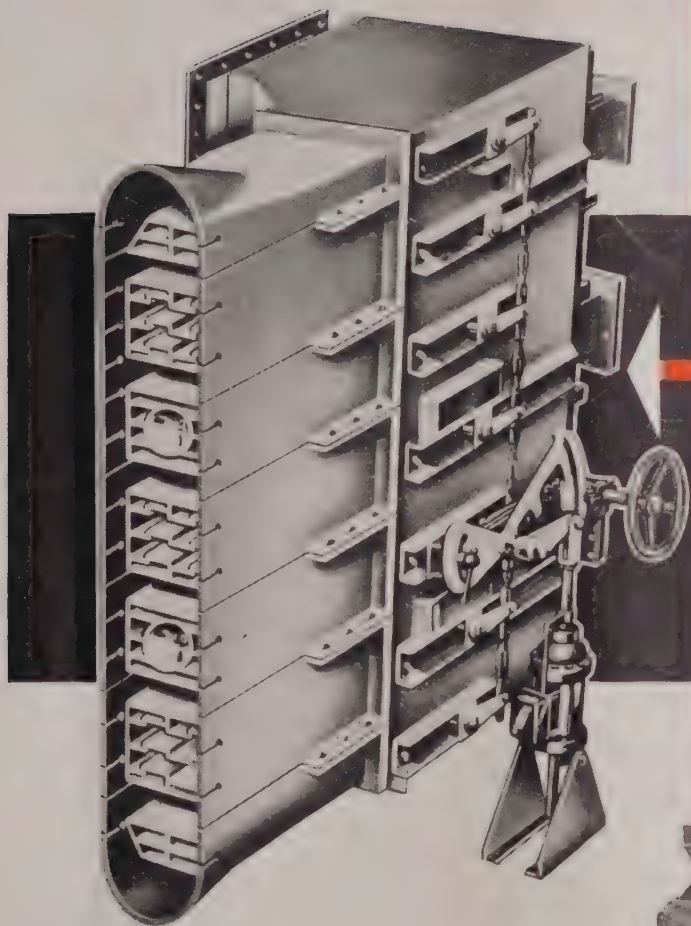
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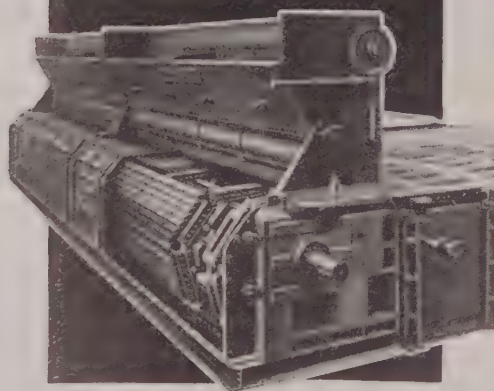
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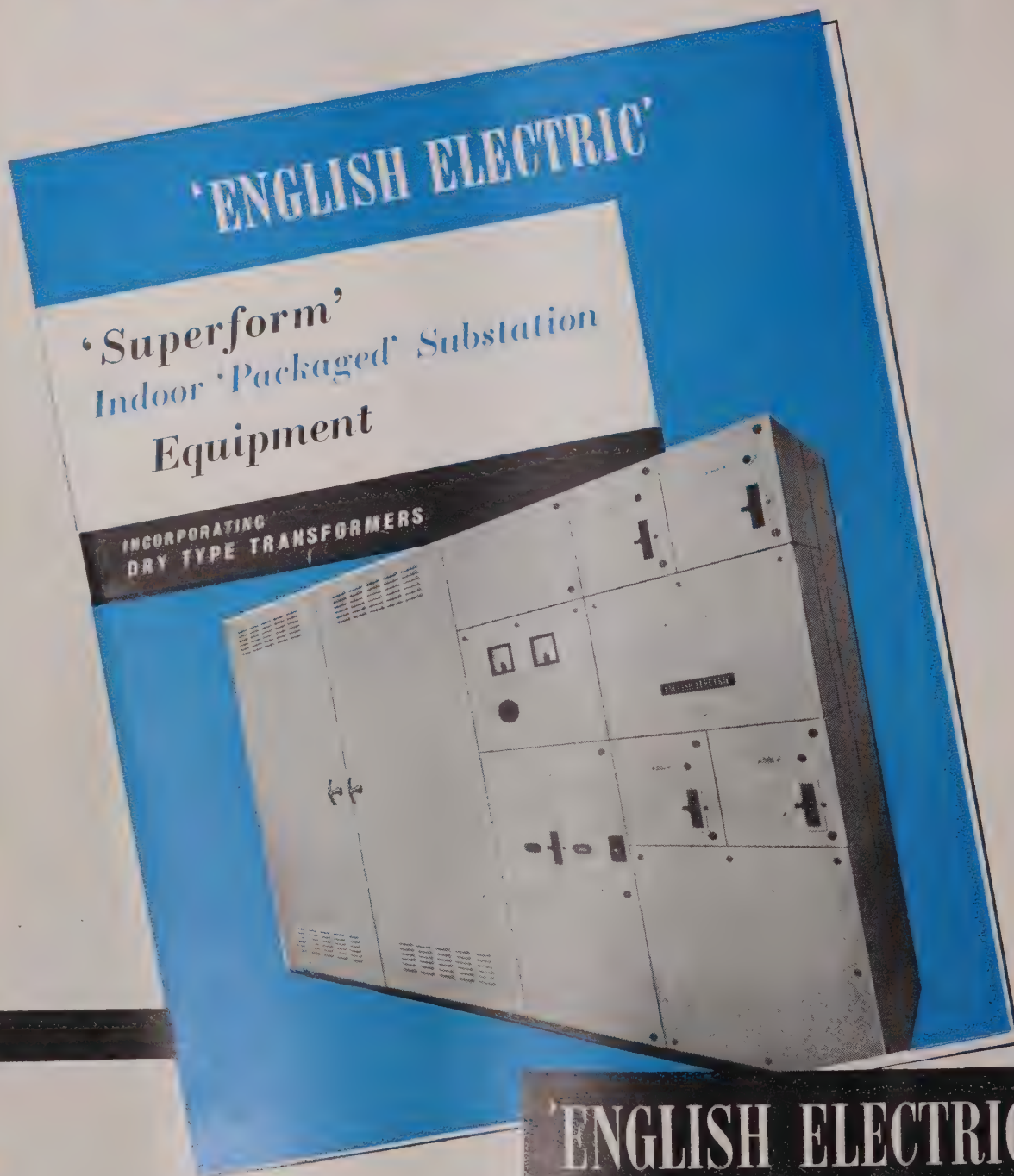


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for leads.

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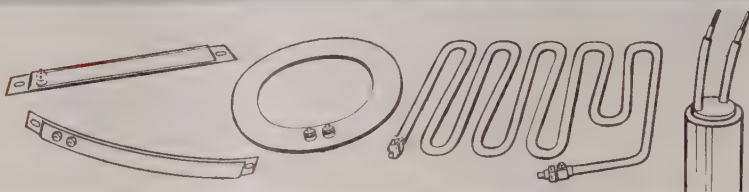
*There's*



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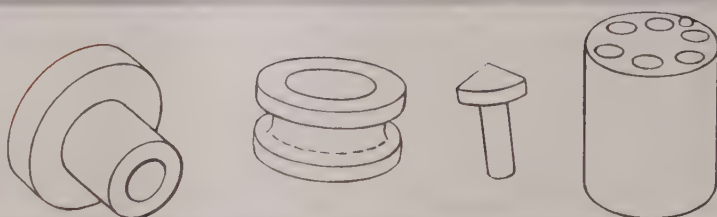
*a bit of*



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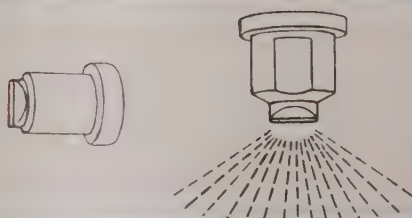
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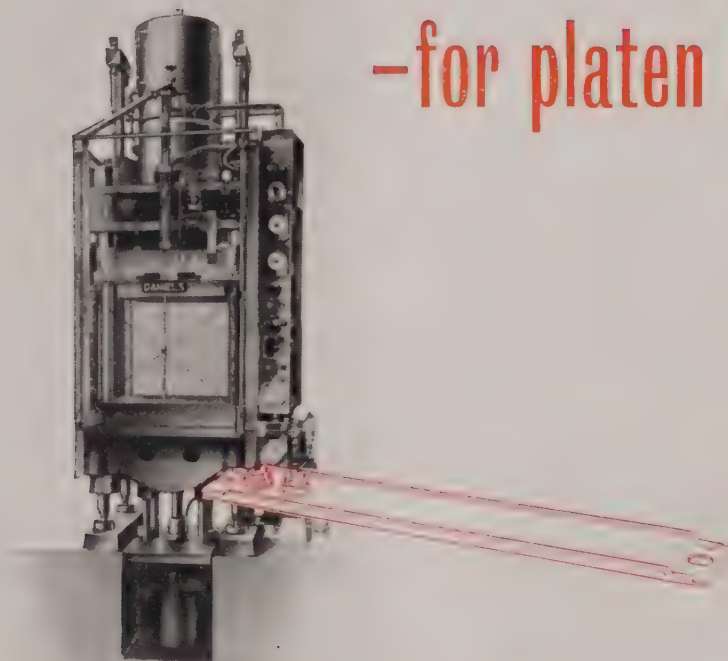
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*everything*

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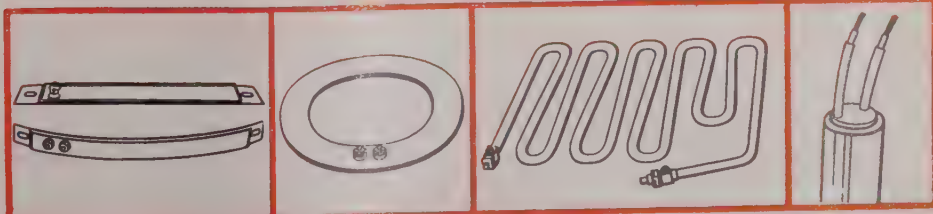
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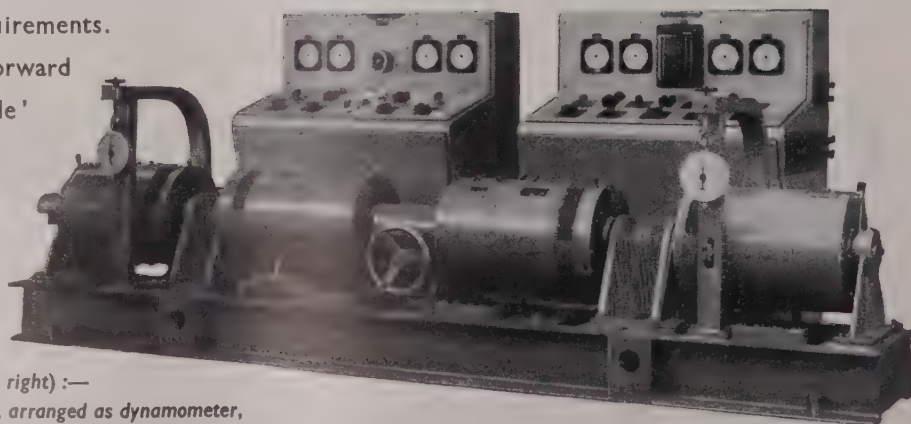


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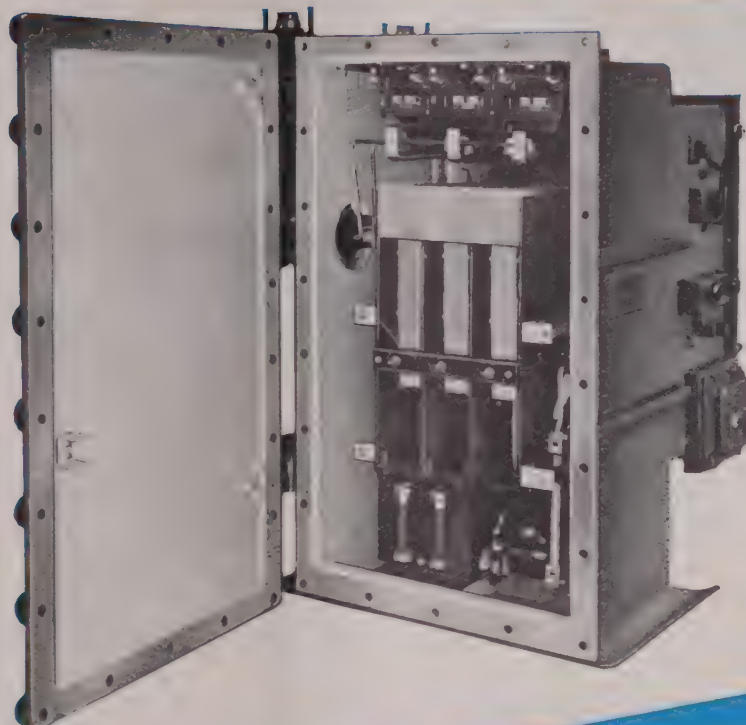
● The complete unit can be split into two motor-alternator sets

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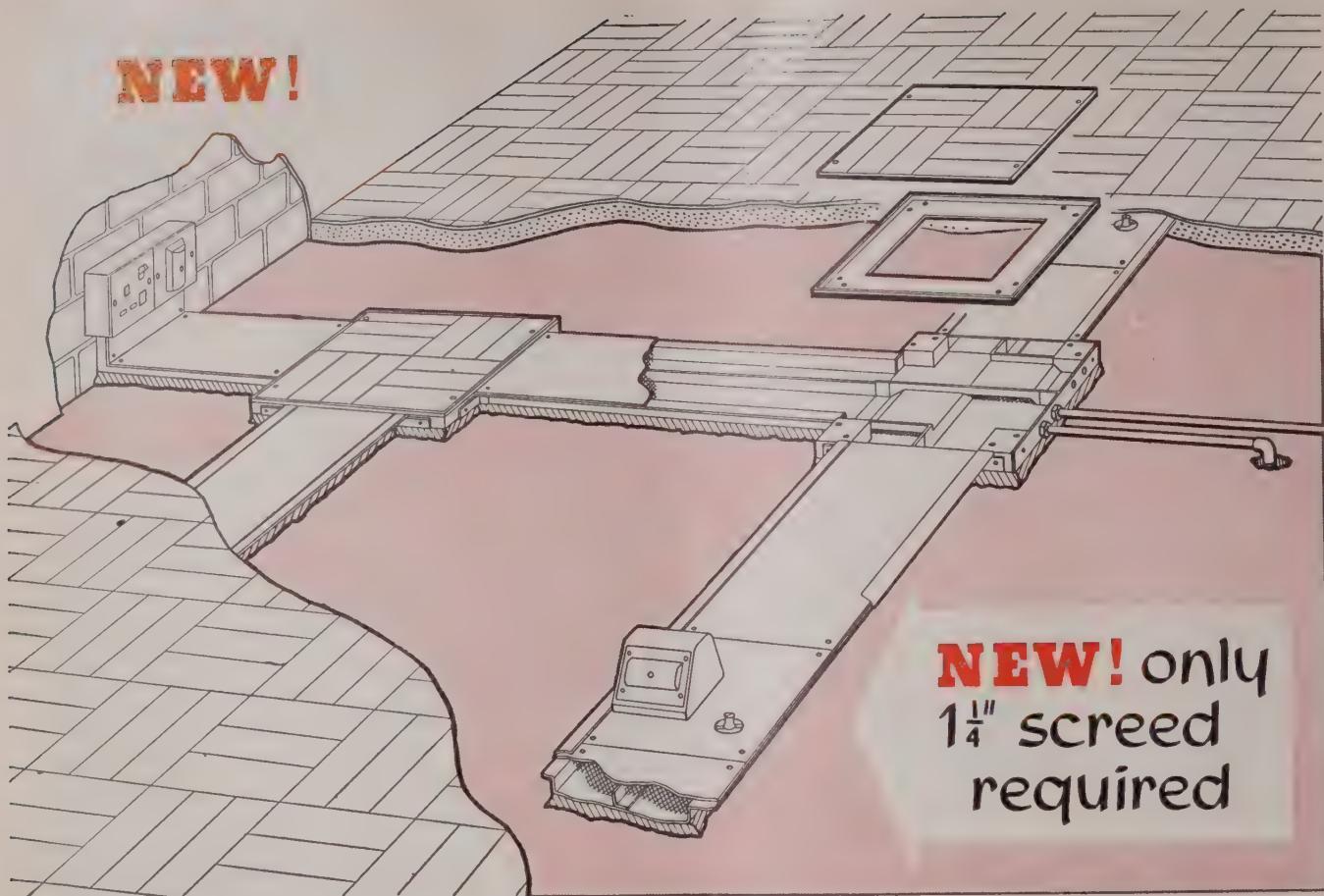
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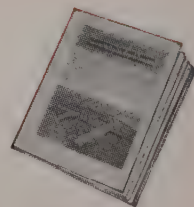
★ Duct covers can be supplied fitted with  $1\frac{1}{4}$ " diameter outlets or may be added at any future date.

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GC 71

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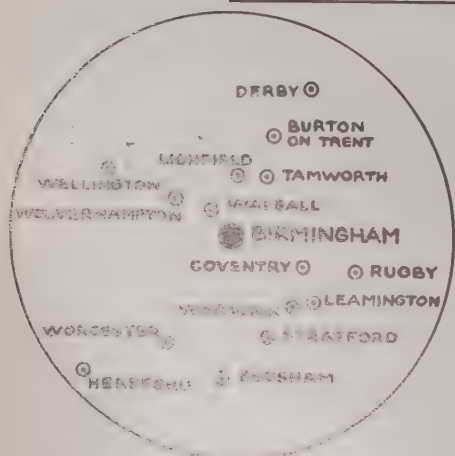
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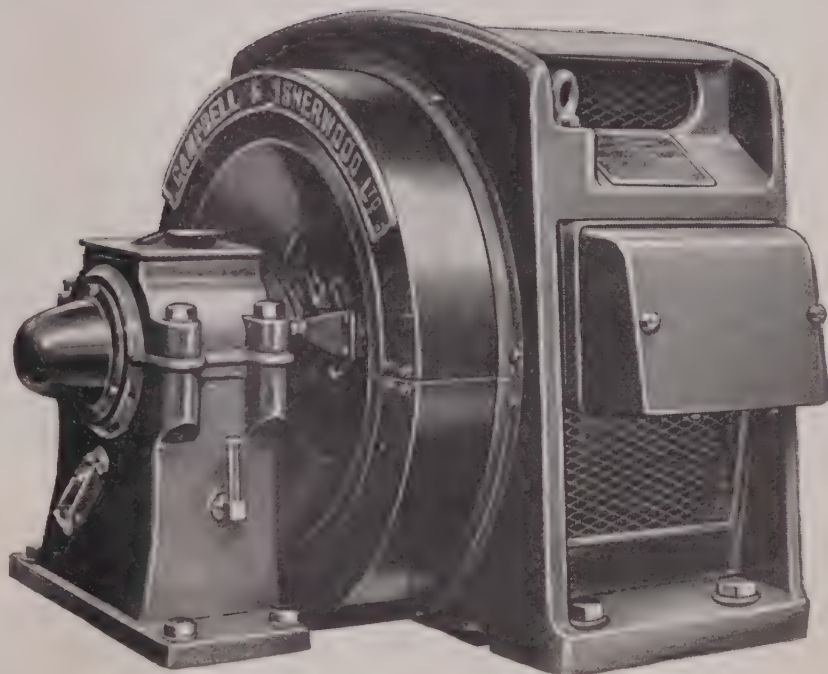
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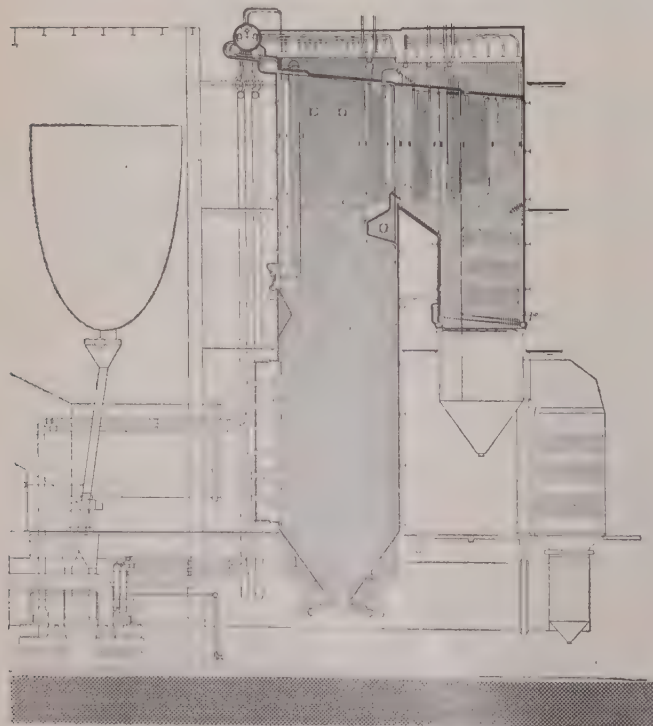


Ferrybridge 'B' power station;  
Yorkshire Division, Central Electricity Generating Board.

# BABCOCK at *Ferrybridge 'B'*

## STEAM-RAISING PLANT

**THREE 760,000 lb./hr.,  
P.F.-FIRED, RADIANT-TYPE,  
'REHEAT' BOILERS, steaming  
100 MW GENERATORS**



The Ferrybridge 'B' power station is one of the first to be commissioned of the Central Electricity Generating Board's modern "reheat" installations; with its three Radiant-type reheat boilers, all supplied by the Babcock organization and each steaming a 100 MW generator as a single boiler/turbine unit.

The boilers, each with a capacity of 760,000 lb./hr. M.C.R., at 1,600 lb./sq. in. and 985°F final temperature, with reheat to 955°F, are pulverized fuel-fired by 20 horizontal circular-type burners supplied from five Babcock type 'E' pulverizing mills, per boiler. Other Babcock equipment includes the automatic lighting-up and low-load-carrying oil burners, the automatic, sequence-controlled system of "Uni-directional-drive" and rack-type soot blowers; and Bailey boiler controls.

FRIDAY  
17 JUNE  
1960

# ELECTRICAL REVIEW

Managing Editor:  
HUGH S. POCKOCK, M.I.E.E.

General Editor:  
J. H. COSENS

Technical Editor:  
A. R. POLLARD, A.M.I.E.E.

## IN THIS ISSUE

<b>Reactor Realism</b>	<b>1147</b>	Comment is made on the implications of the prototype advanced gas-cooled reactor now under construction at Windscale, Cumberland. The A.G.R. is expected to reduce present nuclear generation costs to the level of the best base-load conventional stations
<b>E.H.V. Power Cables</b>	<b>1149</b>	Besides tracing the historical background of e.h.v. power cable development and discussing examples of installations throughout the world, the author indicates future trends
<b>National Inspection Council</b>	<b>1159</b>	The fourth edition of the Council's Roll of Approved Electrical Installation Contractors has recently been published. In this article Brigadier W. G. S. Thompson, chief executive officer and secretary, examines the results achieved
<b>"Once-Through" Super-Critical Boiler and Turbo-Generator</b>	<b>1161</b>	Last Monday the Minister of Power visited the Margam Works of the Steel Company of Wales where new plant has recently been installed in the power station. This consists of a 240 klb/hr Benson boiler with steam outlet conditions of 3,300 p.s.i. and 1,060°F, and a 9.5 MW back-pressure turbo-generator
<b>World Power Conference</b>	<b>1164</b>	Summaries of British papers presented at the Sectional Meeting of the World Power Conference in Madrid. The theme of the meeting was "Methods of Solving Power Shortage Problems"
<b>Portishead "B" Civic Day</b>	<b>1186</b>	The sixth and final set was commissioned at Portishead "B" power station in December, 1959, making the total capacity 390 MW. To mark the completion of the station a "civic day" was held last week

<b>Letters to the Editor</b>	<b>1158</b>	<b>New Electrical Equipment</b>	<b>1184</b>
<b>C.I.G.R.E. Convention</b>	<b>1170</b>	<b>Generation and Development</b>	<b>1189</b>
<b>Industrial News</b>	<b>1171</b>	<b>New Patents</b>	<b>1190</b>
<b>Views on the News</b>	<b>1175</b>	<b>Contract Information</b>	<b>1192</b>
<b>Birthday Honours</b>	<b>1176</b>		
<b>Personal and Social</b>	<b>1177</b>	<b>CLASSIFIED ADVERTISEMENTS</b>	<b>101</b>
<b>Financial Section</b>	<b>1180</b>	<b>INDEX TO ADVERTISERS</b>	<b>116</b>

VOLUME 166 NUMBER 25      ♦      Eighty-Eighth Year of Publication      ♦      FRIDAY      PRICE 1s 6d

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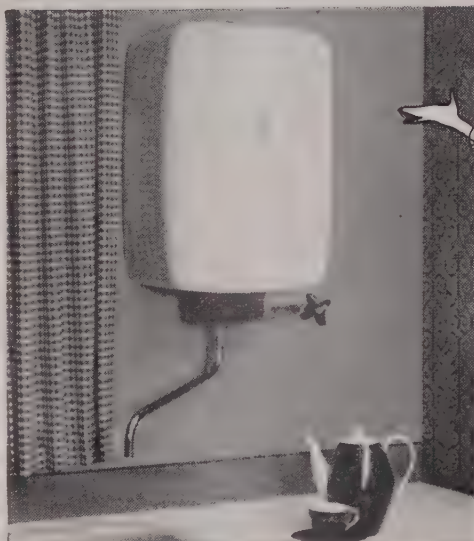
# SELL THE WATER HEATERS THAT CATCH A WOMAN'S EYE—Berry's

Husbands pay, of course, and make knowing noises when you talk of lagging and thermostatic control and B.S.S. 843. It's the least they can do. But when you come right down to it, this is a kitchen feature, and it has to please the head of that department. Which is only right, considering how much of her life she is going to spend with it. Instant hot water she must have—at the turn of a tap—and how much nicer if it comes from a sleek, smooth shape in one of four attractive finishes. From a Berry's A.Q./3 in fact.

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In white, cream, pastel blue, pastel green.  
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**A.Q./1½.** Capacity: 1½ gallons.  
In white, cream, pastel blue, pastel green.  
1kW. (A.C.) £13.0.0. Tax paid.

*Berry's 'A.Q.' water heaters are most efficiently lagged and are fitted with thermostatic control. All tests and general performance comply with B.S.S. 843.*



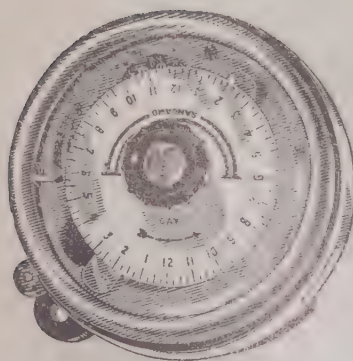
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# ELECTRICAL REVIEW

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## *Reactor Realism*

SO far as the immediate nuclear power programme is concerned, the only suitable fuel is uranium, which occurs naturally. All other nuclear fuels have to be produced artificially. Natural uranium, however, contains only one part of U235 to 138 parts of U238. For a chain reaction to occur with this material, it is necessary to introduce a moderator to slow the neutrons down to thermal energies. Otherwise, the U238 captures most of the fission neutrons and thus prevents a chain reaction. The only available moderators are water, heavy water, beryllium and carbon (in the form of graphite).

When the nuclear power programme was initiated, only natural uranium was available in quantity and fast reactors without moderators were, therefore, out of the question. The only choices open to the United Kingdom Atomic Energy Authority were the type of moderator and coolant to be used. While the moderator could have been either graphite or water, graphite has proved to be the best choice for a large base-load plant. The choice of a coolant was limited by the use of an indirect cooling cycle. Carbon-dioxide gas was chosen because of its low neutron absorption and the ease with which it can be produced.

Unfortunately, the present Magnox reactor has little export potential and the present type of civil reactor will not produce electricity as cheaply as a conventional power station. Entirely new reactor systems, for example the fast breeder, cannot become commercial possibilities for about another 12 to 15 years, since the experimental stages of these projects have only just begun. However, the experience gained by the U.K.A.E.A. in graphite-moderated, gas-cooled reactors has enabled further development of this system to be carried out in an effort to reduce electricity production costs by nuclear means. At Windscale, the Authority is building a commercial prototype of the advanced gas-cooled system and at Winfrith Heath an experimental high temperature gas-cooled reactor is under construction. If the H.T.G.C. experiment shows promise, a commercial prototype would have to be built and civil stations of this type might be planned towards the end of the next ten years. It now seems certain, however, that the next "generation" of nuclear stations will be operating by 1967-69 with the A.G.R. system, as this is the only new power reactor system at present in the prototype stage in this country.

The A.G.R. is expected to reduce power generation costs by about 0.1d per kWh and so reach parity with production costs of the best base-load conventional stations. The A.G.R. at Windscale is a 28 MW (electrical) prototype of future civil stations; it is not an experiment, and therefore we



published a full technical description of its features in the opening article in our last issue. In recent months, a number of opinions have been expressed that the Windscale A.G.R. will prove to be another white elephant because it may be overtaken by a more advanced reactor system. This reasoning seems to us to be entirely unfounded, and we were very impressed by the progress which has been made when we visited Windscale recently.

The A.G.R. will operate at temperatures 200°C (392°F) above those in use in the Magnox reactors, enabling a 900 p.s.i., 900°F conventional turbine to be used. It will have six times the rating of an equivalent sized Calder Hall. It will therefore be possible to provide an economic steel containment vessel for civil reactors of this type, so that these power stations could, in fact, be sited without regard to accident hazard problems. The only fundamental difficulty which it seems has yet to be overcome is the supply of sufficient enriched uranium for the civil A.G.R. station fuel. If military stockpiling continues, it may have to be purchased from America.

### THE HONOURS LIST

There will be general pleasure in the electrical industry at the promotion of Mr. C. R. King, the chairman of the Electricity Council, to K.B.E., and at the knighthood bestowed upon Mr. W. H. McFadzean, chairman of British Insulated Callender's Cables, Ltd., and president of the Federation of British Industries. Likewise the appointment of Dr. T. E. Allibone, director of the A.E.I. Research Laboratories, as C.B.E. will be welcomed as recognition of his services to electrical science. Mr. F. J. Erroll, Minister of State at the Board of Trade, is another well-known electrical man in the Honours List; he becomes a Privy Councillor. To these and other electrical people in the List we offer our heartiest congratulations.

### POINTS FROM PORTISHEAD

In accordance with our policy of publishing an account of new generating stations at a comparatively early stage in their construction to acquaint readers with the latest practice, Portishead "B"—where a "civic day" was held last week to mark the completion of the station—was fully illustrated and described in the 22nd June, 1956, issue of the *Electrical Review*, shortly after the second set was commissioned. It is, however, still noteworthy for a number of interesting features, which are briefly outlined elsewhere in this issue, even though the set ratings and steam conditions have been superseded. Most of these features stem from site conditions. Tidal flow in the Severn Estuary has necessitated reversing characteristics for the circulating water intake and outlet system, while the large water level range of over 50 ft has resulted in the use of pits for the condensers and c.w. pumps, which are shaft driven from motors mounted at the turbine hall basement level. Other features include the moving of

a railway station and the use of tunnels under the lock entrance to Portishead dock for the feeders to the grid switching station. Dual, coal/oil, firing is employed and a high boiler availability has been achieved, while since installation the turbo-alternators have been upgraded.

### E.P.E.A. AND STRIKES

When the manual workers in the electricity supply industry are involved in a wages dispute and strike, or threaten to strike, the technical staff are placed in a difficult position. Their organisation, the Electrical Power Engineers' Association, is a trade union (affiliated to the T.U.C.) but at the same time it is a body of professional men; this duality makes things awkward.

Asked at a recent meeting for a statement of the National Executive Council's policy in this matter, the general secretary (Mr. H. Norton) replied that in the case of an "unofficial" strike the utmost would be done to ensure continuous operation and "without hesitation" the members would be called upon to give every assistance. A manual workers' strike could be "official" only if the five unions concerned collectively decided that it was. In this event the E.P.E.A. would support the party prepared to go to arbitration. This seems to us a reasonable (and perhaps the only) attitude. It must be added that more often than not it is the employers' side which advocates arbitration.

### PRIEST RAPIDS SETBACK

The political and other difficulties that British manufacturers have to overcome in selling power plant in the United States, and the publicity that inevitably attaches to foreign contracts, make a failure such as that which has occurred in one of the five British transformers at the Priest Rapids station on the Columbia River doubly unfortunate. There will be much sympathy for the English Electric Co., especially as the equipment which it is supplying for this major project, which includes also the ten turbines and generators, has been arriving on the site well in advance of schedule.

In their efforts to restrict imports of heavy electrical equipment, American manufacturers have emphasised the possible strategic dangers of using foreign plant in the electricity supply industry. These arguments were largely rejected in a report issued a year ago by the Director of Civil and Defense Mobilisation, but he nevertheless recommended that Federal departments and agencies should consider including in their invitation to bid a provision requiring suppliers to have adequate repair and maintenance facilities on the North American Continent. The penalty clauses in this contract are particularly onerous but the early deliveries should allow the modifications to the transformers, which will be mostly done in Canada, to be completed well before these are invoked. If this is achieved it will demonstrate that fears of the consequences of failures of imported plant can be exaggerated.

# E.H.V. POWER CABLES

## Recent Developments and Installations

By C. C. BARNES, M.I.E.E., M.Amer.I.E.E., A.B.I.M.\*

The primary problem in the development of e.h.v. power cables has been prevention of ionisation in voids. After tracing the historical background, Mr. Barnes discusses some examples of e.h.v. cable installations throughout the world and describes how the design difficulties were overcome

SINCE Ferranti installed the first 10 kV cable at Deptford in 1890, there has been a slow but steady improvement in the quality and performance of e.h.v. power cables. After the Ferranti cable, the well-known "solid" or "mass-impregnated" paper-insulated lead-sheathed construction was evolved for 6.6 and 11 kV service. For 33 kV operation, the introduction of electrostatic screening by Hochstadter extended the range of the "solid" type construction, but the development of power cables for still higher voltages necessitated years of continuous and searching tests in many laboratories. Fig. 1 shows<sup>1</sup> how the service voltage throughout the world has increased over the past 65 years. The primary problem which had to be solved for e.h.v. cables was the prevention of ionisation in voids in the dielectric formed by the thermal expansion of oil, or compound, during variations of load.

### E.H.V. Cable Trends

The first successful commercial method for the prevention of voids consisted of providing devices for maintaining constant oil volume in the cable, the surplus hot oil being accommodated in conveniently situated reservoirs external to the cable and so arranged that, when any reduction in the load occurred, oil was automatically fed into the cable. Modern pressure cables, designed to eliminate the possibility of ionisation at the highest transmission voltages, use one of the following alternative techniques:—

(1) A highly mobile thin oil, which will completely fill the dielectric structure under all conditions of operation (oil-filled cables).

(2) High gaseous pressure to ensure that the ionising potential in any voids will be much greater than the voltages imposed upon the voids in service (gas pressure cables).

The first pressurised construction was the oil-filled system described by the late Luigi Emanuelli in 1917. The 1923-25 Chicago and New York oil-filled cables, based on the design of Dr. Emanuelli, brought this system into prominence.

In an I.E.E. paper in 1909, E. A. Watson gave an account of his work at Liverpool University on the suppression of ionisation by increasing gas pressure and about 1921, Fisher and Atkinson in America suggested that the principle of ionisation suppression by high gas pressure might be employed. As far back as 1899, however, Paschen stated in mathematical terms that the

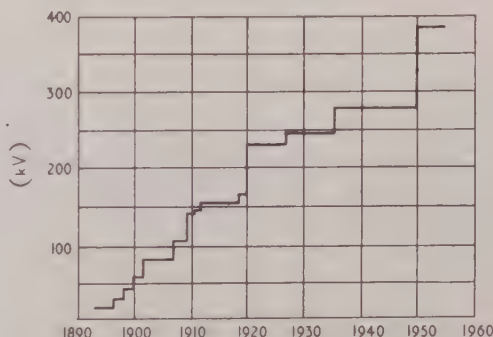


Fig. 1.—Maximum transmission voltages in use in electricity supply systems throughout the world



Fig. 2.—132 kV, three-core pipe type compression cable (external gas pressure). (Enfield Cables, Ltd.)

\* Central Electricity Generating Board.



electrical performance of a gas is a function of the mass of the gas lying between unit area on the electrodes (i.e. if the mass of gas between electrodes is kept constant, then the breakdown voltage will remain unchanged), but this fundamental information was not related to cables until the Fisher and Atkinson patents.

In 1926, Hochstadter patented a new technique for applying high external mechanical pressure to the cable by means of a fluid, usually a gas separated from the cable by an impermeable diaphragm (Fig. 2). An experimental "compression" (external gas pressure) cable installation using high gas pressure successfully passed a range of tests in November, 1931, and the first commercial installation in the world (66 kV pipe type compression cable) was completed in 1932 by the Central Electricity Board, 2½ miles in length between Hackney and Walthamstow.

Modern British pressure cable designs consist of two gas-filled constructions, the first having a pre-impregnated paper dielectric (Fig. 3), and a later design using a mass-impregnated gas-filled dielectric (Fig. 4). Fig. 5 summarises the salient features of pressure cable designs which have come into use in Britain and overseas and have given successful service.

In 1936, the first underground commercial installation in the world at 220 kV, about 11.4 miles long, was put into operation in Paris. It consisted of three single-core oil-filled cables laid in trefoil formation in U-shaped concrete troughs. The hollow conductor has a cross-section of 0.54 sq in and is insulated with 945 mils ( $10^{-3}$ in) of paper corresponding to a maximum working stress of 90.5 kV/cm. Despite the advent of many new

TABLE 1.—HOT IMPULSE WITHSTAND VOLTAGE TESTS

Three-phase service voltage	Peak impulse voltage
33 kV	194 kV peak
66 kV	342 kV peak
132 kV	640 kV peak
275 kV	1,050 kV peak

synthetic materials it still appears unlikely that the impregnated paper dielectric will be superseded for power cables operating at very high voltages.

Type Tests

In testing cable dielectrics, an agreed technique is desirable to minimise the expense and the time involved, but it is essential also to ensure that the testing procedure is as realistic as possible. For some considerable time, this issue has been reviewed in Great Britain and a type test programme has been mutually agreed by British Electricity Boards and the Cable Makers' Association. Electricity Boards, therefore, base their technical requirements on successful compliance with type tests, which are short-time proving tests made on a miniature cable system incorporating cable, straight-through and trifurcating joints and terminations. These type tests are summarised below.

(1) *Loading Cycle Test.*—Twenty heat cycles of six hours' heating, of which the last three hours must be approximately constant at the maximum conductor temperature plus 5°C (i.e. 85°C+5°C for 33 kV, 66 kV and 132 kV pressure systems), followed by eighteen hours' cooling. The voltage must be maintained continuously at 1.5 times working voltage. For 275 kV service, 1.33 times working voltage is used.

(2) *Hot Impulse Voltage Test.*—The test assembly at the minimum design gas or oil pressure must be submitted to and withstand ten successive negative, followed by ten successive positive, impulses (without arcing horns)

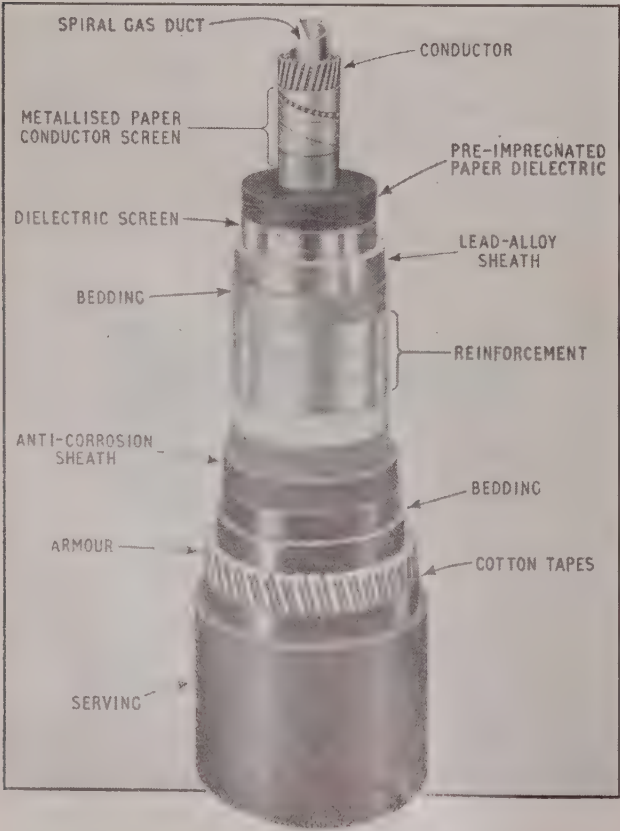


Fig. 3.—138 kV, single-core gas-filled cable. (W. T. Glover & Co., Ltd.)

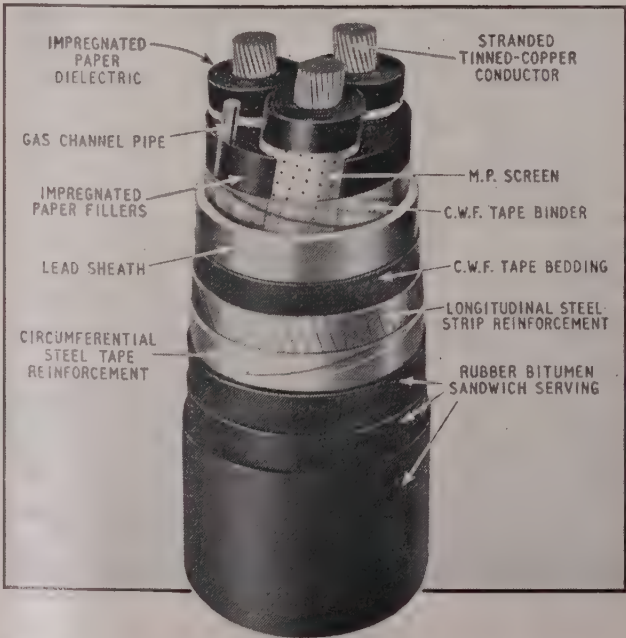


Fig. 4.—132 kV, three-core, mass-impregnated gas-filled cable. (B.I.C.C.)

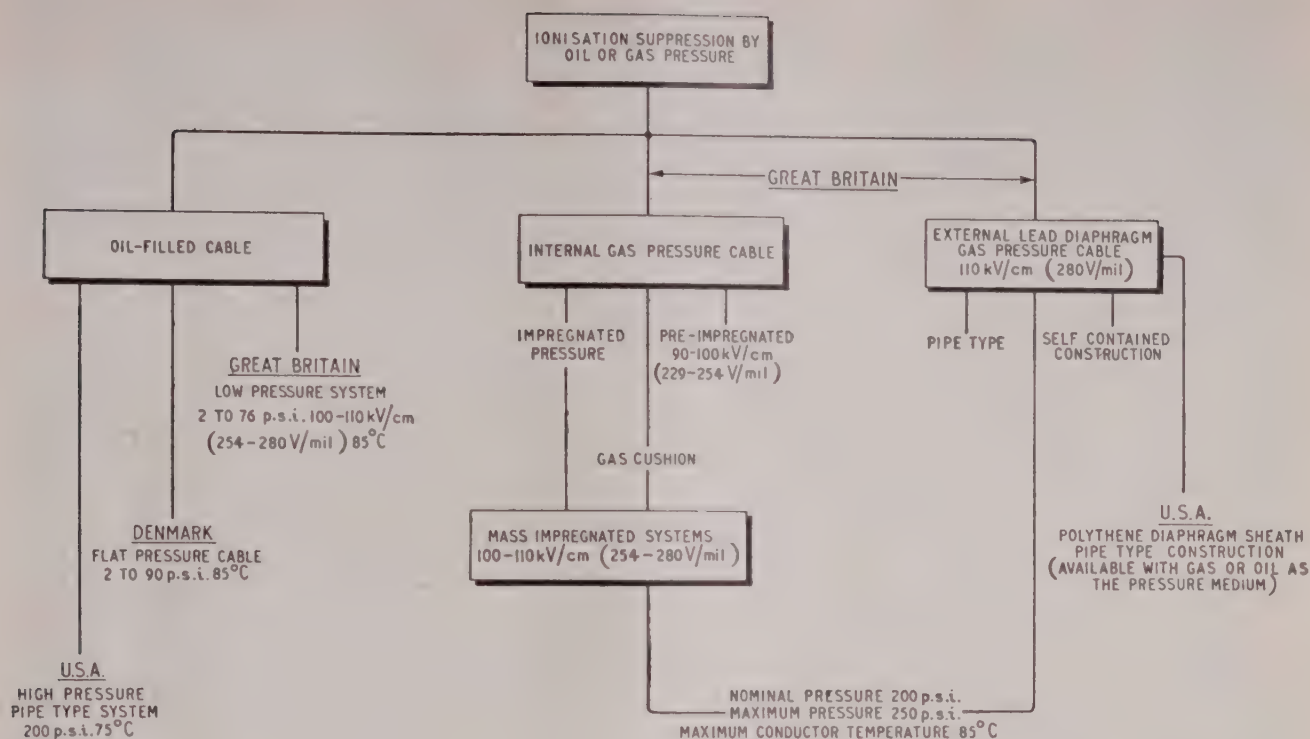


Fig. 5.—High voltage pressure cable systems. (The British design stresses stated are based on successful service experience and/or type tests and apply to a system voltage of 132 kV)

at the voltages given in Table 1. The impulse wave must have a wavefront between 0.5 and 5 microseconds and a time to half-value of 50 microseconds, other appropriate requirements being as B.S. 923. The heating current is maintained continuously during the whole of the testing period.

(3) *Other Tests.*—In addition, the following tests are also carried out:—Cold power factor/voltage, dielectric thermal resistance, mechanical test on the metallic reinforcement, and a penetration and abrasion test followed by a saline bath test on the anti-corrosion coverings. A range of sample tests are also made.

### Testing Stations

The above type tests are complementary to the earlier long-term design tests made by the cable makers as part of their own development programme. Fig. 6 shows a twelve-stage two-column impulse generator with an output voltage of 2.4 MV and a stored energy of 120 kW-secs recently installed in a manufacturer's laboratory. Shedd porcelains are used for housing the stage capacitors and for the spacers. The front and tail resistors are adjusted to produce a 1/50 microsecond waveshape on the test specimen. Each stage capacitor has a capacity of 0.5  $\mu$ F and is charged from a d.c. charging equipment incorporating metal rectifiers so that a voltage of from 0 to 200 kV d.c. can be obtained on each stage, the voltage being infinitely variable through the use of a moving coil regulator. Facilities for automatic polarity change-over are incorporated.

Another British company has just commissioned a new high-voltage laboratory costing £300,000 designed to cater for development testing of cables for operation at the highest voltages that are envisaged in the future. The main items of plant installed include a 3.2 MV impulse generator and an 800 kV a.c. testing set (Fig. 7).

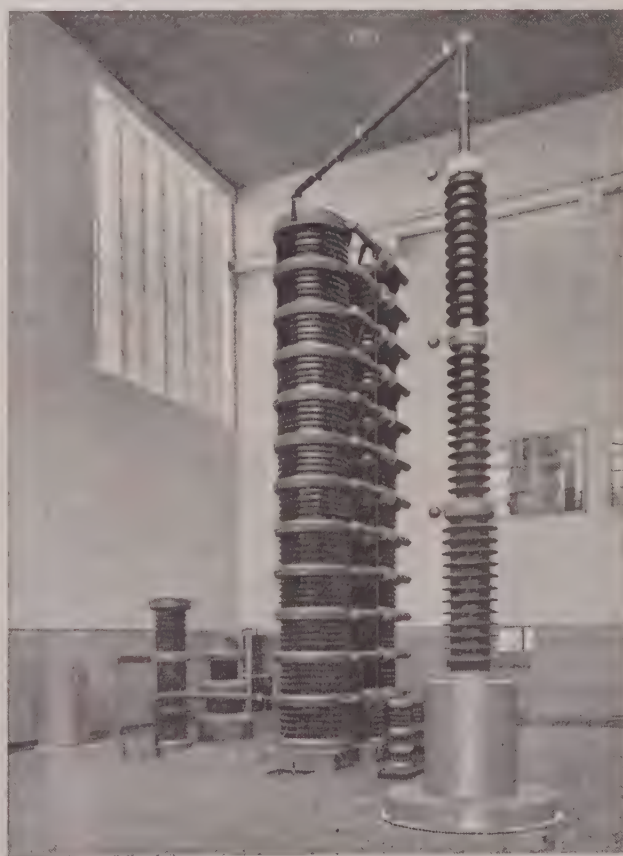


Fig. 6.—Twelve-stage two-column impulse generator. It has an output voltage of 2.4 MV with a stored energy of 120 kW-secs. (Enfield Cables, Ltd.)



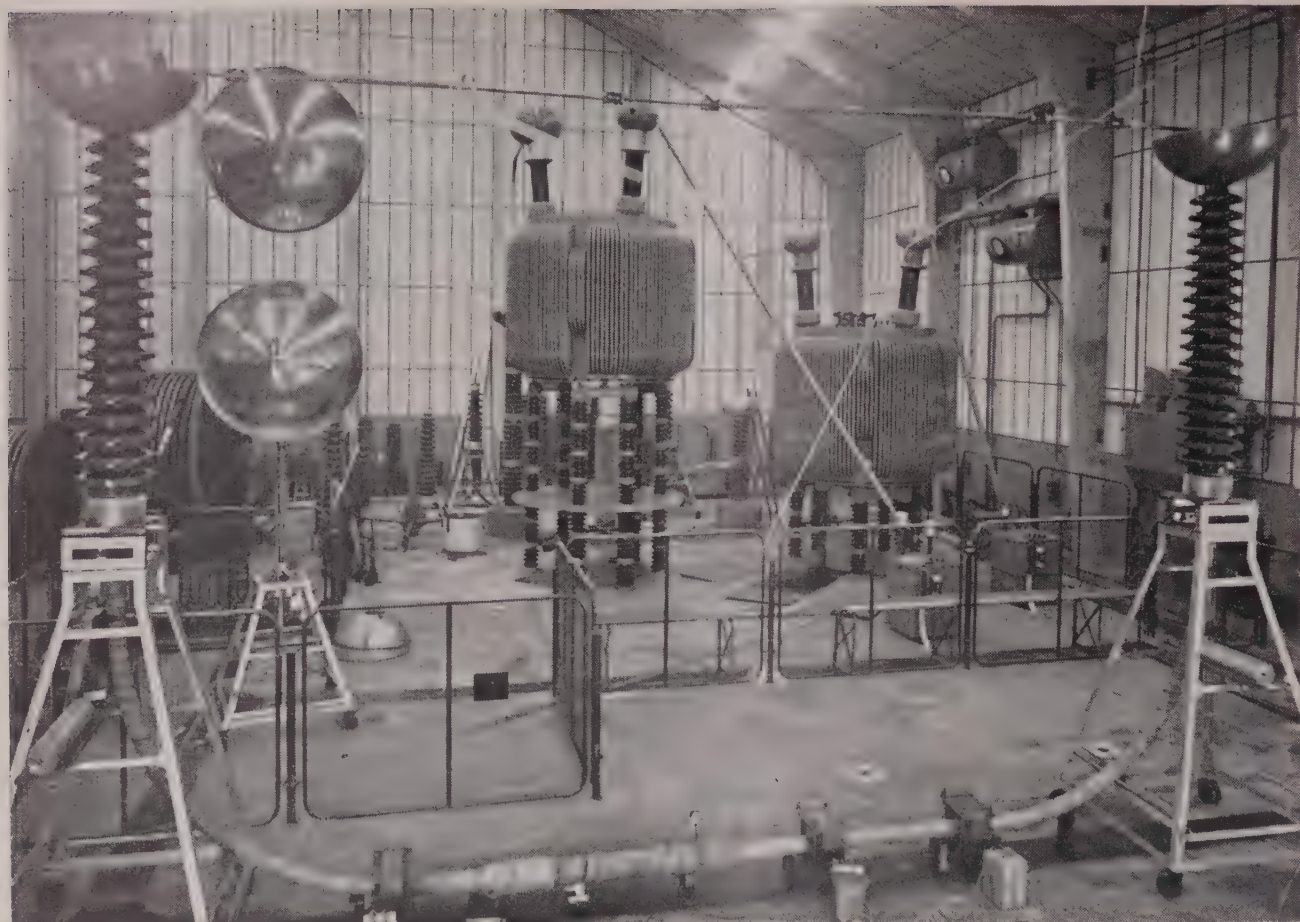


Fig. 7.—800 kV a.c. testing set. The two 400 kV transformers are capable of cascade or parallel operation. (B.I.C.C.)

Based mainly on 132 kV manufacturing and installation experience, British cable makers have developed four pressure cable systems for 275 kV operation. To obtain some service experience at this voltage a testing station was established adjacent to Staythorpe power station where lengths of 275 kV cables, with straight joints and sealing ends, were inserted in series with the Staythorpe-West Melton 275 kV overhead line. This testing station was officially opened in 1954.

Each cable system consists of a 100 yd test loop of single-core 275 kV cable with a straight-through joint and two sealing ends. Surge recorders are provided for recording the frequency and magnitude of impulses impressed on the cables and thermocouples are used for recording sheath temperatures. The line loading was originally restricted to 120 MVA by transformers and special conductor arrangements were, therefore, adopted to give the required conductor section.

The oldest cable testing station, known as K.E.M.A., is at Arnhem, Holland. In 1936, 132 kV cables were being tested there, but during the second world war this testing station was destroyed and it has now been rebuilt and equipped for testing cable up to 330 kV. Electricité de France also have an excellent laboratory for testing e.h.v. equipment at Fontenay, near Paris—the Fontenay station is fully described in C.I.G.R.E. paper No. 221 (1950).

In the U.S.A., studies have shown the need for a development programme on e.h.v. underground cables

capable of carrying 500 MVA at phase voltages up to 345 kV for future bulk transmission requirements. Various manufacturers are developing cables for the 345-400 kV range and plans are being pursued actively to design a nominal 345 kV three-phase test substation at Cornell University with provisions for load cycling at elevated temperatures and under-voltage on a single-phase basis, with the various samples installed under field conditions. The January, 1960, issue of *Electrical Engineering* reported the present position as follows:—

“The underground portion of the testing station has been completed. This includes complete piping for two pipe-type cables, including current transformers for loading; ducts and pothead stands for three self-contained cables; thermocouple installation on the pipes and conduits for monitoring cable temperatures; and concrete bases for transformers and other heavy equipment. It is expected that two pipe-type cables and three self-contained cables will be installed or ready for installation about 1st April, 1960.

“The design of the aboveground portion of the testing station has been completed, and the erection of the station was started in November, 1959. Major electric equipment needed for the testing station is either available or has been pledged. It is expected that preliminary testing and calibration work will be started shortly after 1st January, 1960.

“The four cable manufacturers and two accessory manufacturers have completed, or nearly completed, laboratory tests on the samples of cables and accessories which they will offer for the Cornell field test. The



results of the laboratory tests, including tests on a cable with synthetic tape insulation, have been very encouraging. Based on these laboratory tests, it appears that cable systems will be available which are capable of transmitting 500 MVA or more at 345 kV. It remains to be demonstrated whether such cable systems will remain stable at their initially low dielectric loss levels under actual commercial service conditions. This is an extremely important consideration and the field tests at Cornell are expected to supply an answer to most of the questions which may be raised in this connection."

Information has also recently been published outlining the American General Electric plan called "Project E.H.V." which involves the design, construction and operation of a complete a.c. transmission system which will carry power at voltages from 460 to 750 kV. This system will be a prototype for future extra-high-voltage systems.

### Modern Installations

**230-425 kV Range.**—In 1957, the British Columbia Electric Co., Ltd., successfully placed in service its first 230 kV underground cables with an installation of 14 circuit-miles of oil-filled cable. In America, at Garrison Dam (North Dakota) in 1956, a pioneer 230 kV pipe type cable was put into service, rated for 253 A.

An important British cable installation is the 300 kV Kemano-Kitimat transmission project of the Aluminium Co. of Canada. The specification called for a cable capable of conveying a minimum load of 550 A at 300 kV three-phase, from the underground water power station to the commencement of the overhead line which, in turn, carries the power to an electrolytic refining plant some 50 miles distant. The cable had to be laid on racks at the side of a tunnel which slopes downwards from the underground transformer chamber, the difference in level between the ends being about 36ft. The total length of the cable route is 670 yd. A maximum working stress of 120 kV/cm (305 V/mil) was adopted and the conductor has a cross-section of 0.4 sq in with a central oil duct 0.75 in in diameter.

A major manufacturing problem was to avoid wrinkling and creasing of the insulating papers. Defects of this kind reduce the dielectric strength and must be eliminated. Wrinkles occur when a cable is bent in its undried state and a big improvement is possible by substituting a "caterpillar" haul-off for the normal wheel; but a certain amount of wrinkling and creasing is liable to occur when the cable is bent round a drum as it leaves the paper-lapping machine. It was, therefore, considered essential to apply the papers in the various layers so that they would always slip one upon the other when the cable was bent. For this requirement, a detailed study was necessary of the coefficients of friction between layers of paper and the mechanical pressure existing between the layers due to the tension under which these and subsequent layers were applied. Furthermore, it was essential that the insulation was applied in a single pass through the lapping machine.

Some help for this requirement resulted from the use of thicker paper tapes than usual in the outer (lower stressed) portion of the dielectric, but, even so, additional lapping heads had to be added to the paper lapper to enable all the 151 papers (including conductor and

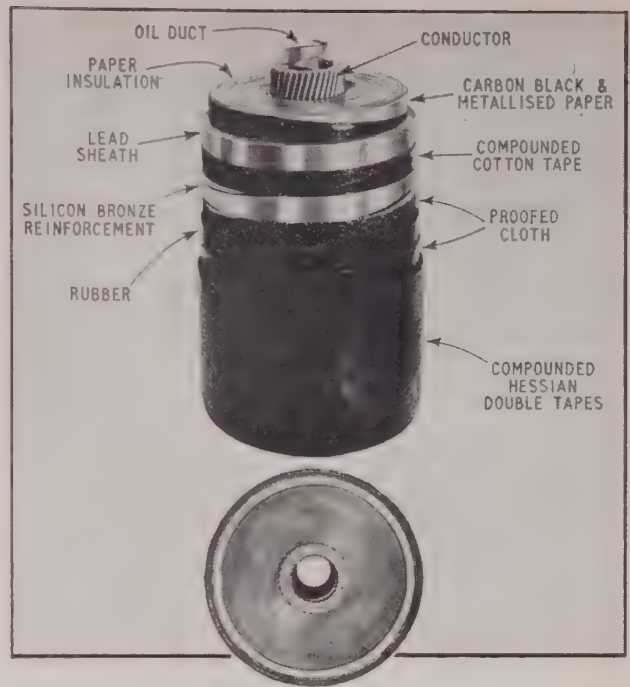


Fig. 8.—300 kV ducted oil-filled cable for Kemano, British Columbia. (Pirelli-General Cable Works)

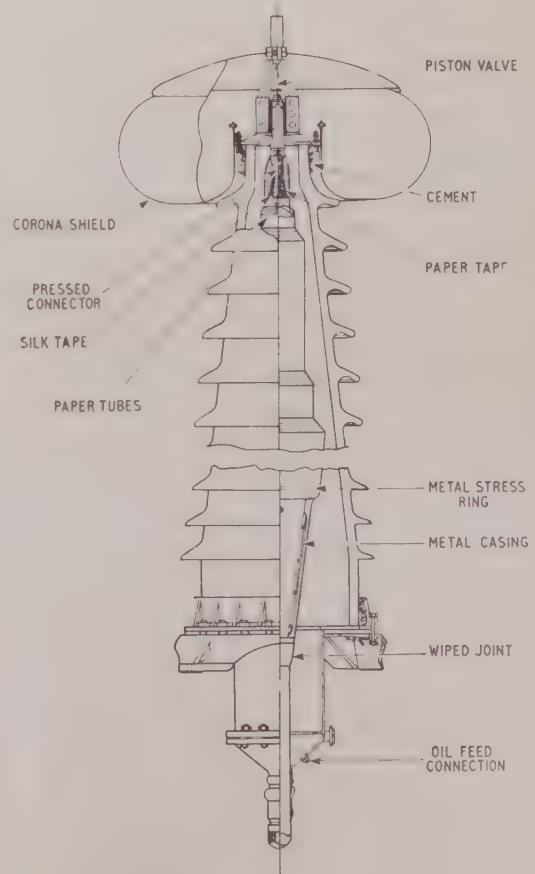


Fig. 9.—300 kV sealing end for Kemano. (Pirelli-General Cable Works)



external screening papers) to be applied in one pass. Fig. 8 shows the 300 kV cable and Fig. 9 a sectional view of the sealing end as finally evolved; no condenser stress control is employed and the porcelains are not resistance glazed. The success of this cable design is attributable to the carefully calculated stress control devices.

In addition to an 85°C load cycle test at 232 kV to earth ( $1.33 \times$  working voltage), the test requirements specified ten negative and ten positive impulses at 1,050 kV peak and an a.c. test of 350 kV to earth ( $2 \times$  working voltage) for twenty-four hours followed by 425 kV ( $2.45 \times$  working voltage) for two hours. Tests carried out on cable which had been subjected to bending four times in each direction round a drum 130 in in diameter, impulse voltages up to 1,250 kV and a.c. voltage up to 500 kV being reached without breakdown, demonstrated that both cable and accessories had an ample margin of safety over the requirements. Additional tests at elevated conductor temperatures were also made. A joint failure occurred at 425 kV a.c. only after the conductor temperature had been held at 100–105°C for a period of ten hours. Under impulse voltages with the whole assembly heated to 84°C, the joint failed at 1,100 kV.

### Australian and African Experience

For the Australian Snowy Mountains hydro-electric project, 0.325 sq in, 330 kV, self-contained, single-conductor, oil-filled cable of British manufacture was used for connection between transformers housed in an underground chamber and overhead line terminal towers. The route length is about 500 yd, the cables being installed in a tunnel after the manner of the Kitimat scheme. The tunnel slopes up from the transformer hall, the difference in level between the oil-immersed sealing ends at the lower end and the outdoor sealing ends being about 210 ft. These cables, supplied without any intermediate joints, are scheduled for 195 MVA (340 A at 330 kV) carrying capacity and have 0.985 in minimum insulation thickness, 3.45 in in diameter over sheath and 3.90 in overall diameter with 42 lb/yd net weight. The static oil pressure is 115 p.s.i.g. at the lower end of the route under continuous full load. Conductor screening is by means of carbon-loaded papers and the design maximum dielectric stress is 130 kV/cm. Seven cables are installed to form two circuits with one spare conductor.

The 330 kV cable for the Kariba hydro-electric scheme in Southern Rhodesia, runs from the power station to an overhead line terminal. This cable is oil filled with 0.85 sq in hollow conductor, insulation thickness of 1.1 in, and an overall diameter of just under 5 in. The maximum design stress of 110 kV/cm at the conductor surface adopted, results from the high impulse test value specified (1.5 MV). It has been stated that the Kariba Plateau is one of the worst lightning areas in the world and, furthermore, the cable is expected to contribute to the protection of the transformers.

The cable route itself is particularly exacting. There are nine cables in three circuits together with a spare. The cable traverses a horizontal tunnel for about 240 ft, until it reaches a 550 ft shaft. Between the shaft and the overhead line, a distance of approximately 700 ft, the

cable is laid direct in steeply-rising ground, bringing the total head to about 600 ft. This is equivalent to an oil pressure at the bottom of 250–300 p.s.i. and the cable sheath is reinforced for that pressure. The porcelain terminal insulators situated at the bottom of the shaft in the power station are subjected to the full oil pressure. They are of single-skin design, associated with condenser-cone stress control which enables the diameter of the porcelain to be kept to the minimum. In the shaft, the cleating arrangements have to be such as to hold the cable without creep. The weight is about 70 lb/yd totalling some 22 tons for each cable. At the same time the cleats must allow for movement in each span due to expansion under load.

The cables were manufactured without joints; this means they were manufactured, shipped and handled on site in 700 yd lengths, involving a gross weight per drum of about 30 tons. The Kariba 330 kV, 0.85 sq in cable corresponds to a current density of about 500 A/sq in whereas the Snowy Mountains scheme uses 0.325 sq in cable which results in a considerably higher current density. According to the I.E.E. paper dealing with the Kariba scheme, this difference is due to high soil thermal resistivity (150°C cm/watt) and temperature (30°C), bonding of the sheaths at both ends, extra reinforcement for the high static head and thicker insulation to withstand the high impulse test level specified.

**400–500 kV Range.**—In Sweden, use has been made of oil-filled cables on the e.h.v. system to connect transformers installed in underground power stations to the overhead lines.

A pioneering achievement of heavy load transmission associated with e.h.v. service requirements was achieved with the installation of 1,096 sq mm (1.7 sq in), 425 kV cables (Fig. 10) at Lasele station, Sweden, in 1955. These 425 kV oil-filled cables, which were manufactured by Câbles de Lyon, are designed to transmit 1,200 A continuously and to carry overloads of 1,500 A for a period of one hour starting from a continuous load of 1,200 A.

Each cable is installed in vertical runs of about 98 ft, each phase being in a separate shaft 35.4 in in diameter and a fourth spare cable is installed in a fourth shaft. The distance between the shafts is approximately 32.8 ft and the ventilation in the shafts and galleries corresponds

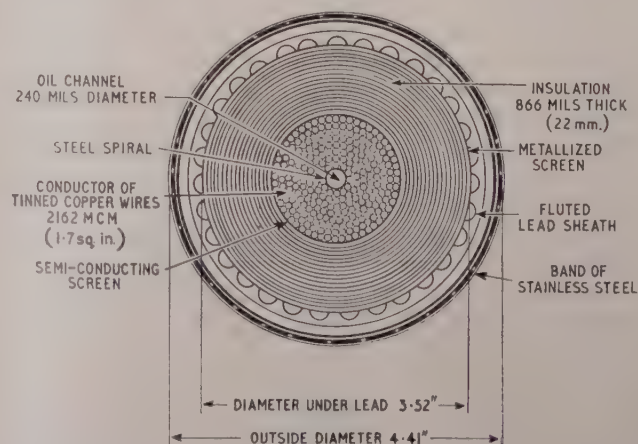


Fig. 10.—425 kV cable for Lasele, Sweden



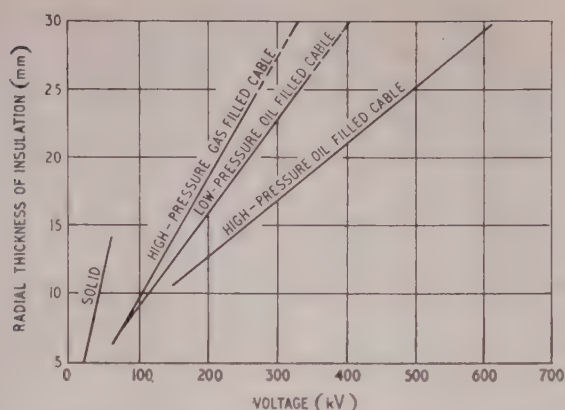


Fig. 11.—Radial thickness of insulation for various types of cable

to an air speed of approximately one metre per second, the air temperature not exceeding 30°C.

These 425 kV oil-filled cables operate under a pressure of 10 kg/sq cm (142.2 p.s.i.). The maximum gradient in the cables when operating at 425 kV is 16.1 kV/mm, the average gradient being 11.1 kV/mm; a sample of this cable withstood, without failure, a surge stress of 124 kV/mm.

In July, 1956, further 425 kV, 1,096 sq mm cables, manufactured by Câbles de Lyon for the Kinstad station in Sweden, were tested. The cable was subjected to dielectric loss measurement at 50 c/s on complete lengths, typical values of the tangent loss angle at 28°C being 0.0025 at 185 kV and 0.0026 at 350 kV, and the capacity was 0.296  $\mu$ F/km. Complete lengths were also subjected to a 50 c/s one-minute test of 450 kV with an oil pressure of 15 kg/sq cm and temperature of 28°C. Impulse tests were made on a sample 59ft after it had been bent six times (three in one direction and three at 180°) around a mandrel 10.7ft in diameter and terminated at each end in outdoor sealing ends. This assembly was maintained with oil pressure at 10 kg/sq cm.

Five impulses of 1,500 kV positive polarity were then applied followed by five shots, negative polarity, of 1,500 kV. The waveshape was 1×50 microseconds. 450 kV, 50 c/s was then applied for 30 seconds. Further tests were then made as follows:—Three shots at 1,650 kV negative, followed by 450 kV, 50 c/s for 30 seconds, three shots at 1,800 kV negative, followed by 450 kV, 50 c/s for 30 seconds, and three shots at 1,900 kV negative. When the first impulse voltage at 1,900 kV was applied, an instantaneous increase of pressure from 10 to 12.5 kg/sq cm was observed and when the 50 c/s voltage was applied, internal flashover occurred at one of the terminals when 370 kV was reached; the breakdown was found to have produced a discharge path in the terminal.

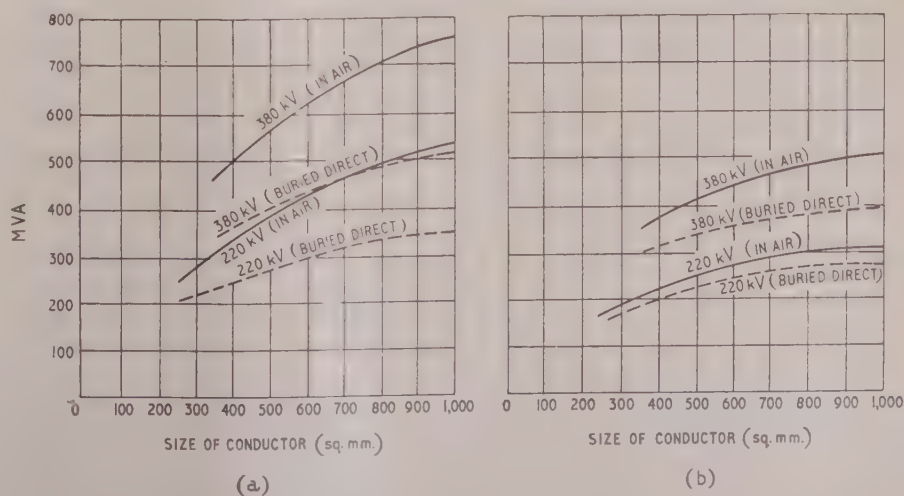
A cable section approximately 30 cm long, taken about two metres from one of the

terminals, was dissected and this examination failed to disclose any tears in the paper tapes, not even in the very thin paper tapes in the vicinity of the conductor.

The following observations by M. L. Domenach,<sup>2</sup> relative to the cables at the Lasele power station, are of particular interest:—

“The thickness of insulation on the Lasele 425 kV oil-filled cable is 22 mm, 2 mm less than that of the cables at Harspranget, made possible by a new arrangement of semiconducting thin paper screen. The oil feed through the central duct of the cable is supplemented by an additional supply at the periphery of the insulation along channels formed in the lead sheath so as to reduce the pressure drop of the radial transmission of the pressure due to the density of the thin papers. The Swedes, who are desirous of increasing the a.c. voltages of some of their power stations, have given us an order for 500 kV cables for the Stornorfors and Grundfors power stations. On account of the magnitude of the dielectric losses, which increase with the square of the voltage, and as the distances were short (less than 200 mm), it was decided to attempt to cool the cables by forcing the cable oil to circulate through a cooler. The researches carried out in our laboratories during the last year gave promise of satisfactory results. The conductor section of the cable was reduced to 405 sq mm instead of 1,100 sq mm, to transmit 880 MVA at normal rating and 1,100 MVA on overload. This reduction greatly facilitates manufacture and increases the flexibility of the cable. The heat dissipated in the cooler is sufficient to remedy both the dielectric losses and the joule effect losses in the conductor. Due to the precautions taken, there have been no changes in the dielectric losses of the oil in the cable channels after six months of heating cycles (on an experimental length of 100 m). In respect of the construction of the cable, rupture during shock tests after bending, in stages of 100 kV at the rate of two negative shocks per stage after 1,000 kV, took place at 2,200 kV, which provides a large safety margin as the insulation level exacted is only 1,600 kV. It is probable that a cable of this type with a thickness of insulation of 28 mm would be suitable for voltages of 650 kV and lengths of 200 m.”

For voltages of 400–500 kV, Domenach emphasises



(a) Lead sheath reinforced and insulated cables.  
(b) Pipe type cables.

Fig. 12.—Powers transmitted at 220 and 380 kV



that it is necessary to attain working stresses of the order of 160-180 kV/cm, and states he obtained these results with the combined use of pressure and thin paper in the vicinity of the conductor, these papers being five to six times thinner than those habitually used for cable insulation. Figs. 11 and 12 (due to Domenach) indicate possible thicknesses of insulation as a function of the service voltage, and the power (MVA) which can be transmitted for various designs of 220 and 380 kV cables.

High-Voltage D.C. Transmission

Possible future demands for the transmission of large blocks of power over distances of several hundreds of miles are tending to make conditions favourable for high-voltage d.c. schemes; a project is being considered in New Zealand for a d.c. cable link between the North and South Islands, while the Straits of Gibraltar and the Islands of Japan also represent future possibilities for high-voltage d.c. cables.

In 1953, in Sweden a 20 MW, 100 kV, d.c. submarine cable, approximately 60 miles in length, was successfully laid from the mainland to the Island of Gotland in the Baltic Sea. A d.c. submarine cable link between England and France, approximately 30 miles route length, is planned for 1960-61 and, in due course, it will provide valuable data and experience.

High-voltage d.c. transmission necessitates the provision of special equipment to convert from d.c. to a.c. and at the present stage of development this equipment is exceedingly expensive. The use of d.c. will permit savings in cable costs, but at the present time these savings do not compensate for the high price of conversion equipment until distances of at least 30 miles are considered. However, knowledge obtained from the cross-Channel cable project and similar schemes, together with improvements obtained by research and development, must in time produce cost reductions which will make d.c. projects more attractive.

Future Trends

An important trend in cable research and development has been directed to increasing dielectric strength and reducing the losses in cable insulation to permit increasing the conductor section and/or the voltage rating without making the cable dimensions excessive

and uneconomic. The rapid trend in recent years towards larger generating units, and system load growth have also emphasised the need to achieve greater capital and operating economies. In addition, difficulties in obtaining wayleaves for overhead lines have produced circumstances which tend towards an increasing use of underground cables. These factors, therefore, necessitate consideration of the magnitude of the loads which future e.h.v. cables will have to handle.

Increase in capacity of individual turbo-alternator units since the war from 60 to 550 MW has been followed by a corresponding increase in the capacity of individual stations. Sites are now being developed for capacities of between 1,500 MW and 2,000 MW. In 1950, the construction of the 275 kV supergrid was started and the first section, 42 miles, was brought into commission in 1953. By the end of March, 1958, 726 route-miles of the supergrid had been commissioned and a further 1,096 route-miles are under construction or approved for construction. The 275 kV system has a carrying capacity six times that of the 132 kV grid. To provide for possible development in the more distant future, the transmission towers on most supergrid lines have been designed so that the lines can be converted to operate at 380 kV.

At 275 kV, the cost of underground cables varies according to the terrain, but it is about twelve to sixteen times as much as for an overhead line of equivalent capacity. However, a demand always exists for e.h.v. cables as appendages to overhead lines because of some peculiar local obstruction or restriction which prevents direct access by overhead line to a generating station or switching substation. The power transmission capability of underground power cables suffers from thermal restrictions imposed by three inherent physical properties of the cable insulation, viz. the permissible operating temperature, the dielectric power factor and the dielectric constant.

When the temperature of a cable is increased excessively the paper tapes forming the insulation are the first component of a cable to show signs of chemical deterioration. Clark<sup>3</sup> and Murphy<sup>4</sup> investigated the stability of paper in relation to temperature. They found that the decomposition of the paper is already measurable below 100°C, but the rate of decomposition is negligibly small. 120°C is the order of temperature at

TABLE 2.—PERCENTAGE REDUCTION IN CURRENT RATING DUE TO DIELECTRIC LOSSES

Copper section sq in	33 kV		66 kV		132 kV		275 kV	380 kV
	Single-core H type	Three-core H type	Single-core H type	Three-core oil-filled	Single-core oil-filled	Three-core (IP) gas-filled cable	single-core (IP) gas-filled cable	single-core (IP) gas-filled cable
0.25	Less than ½	1	1½	1	2½	2½	—	—
0.50	Less than 1	1½	2	1½	3	3½	"e" ratio 7½	—
1.00	1	—	4	—	4	—	8½	"e" ratio 14½

NOTES:—275 kV: The value for 1410/ refers to an "e" ratio cable which for a conductor stress of 110 kV/cm at this voltage is equivalent to a conductor size of approx. 0.75 sq in.  
380 kV: The value for 1610/ given refers to an "e" ratio cable which for a conductor stress of 130 kV/cm at this voltage is equivalent to a conductor size of approx. 1.00 sq in.  
Standard S.I.C. values have been used and standard power factor values at 85°C for both oil-filled and impregnated pressure (gas-filled) cables up to 132 kV. For 275 kV and 380 kV cables a power factor of 0.0025 has been taken.



which decomposition becomes technically important. This temperature, therefore, constitutes an upper limit for the operation of paper-insulated cables.

The magnitude of power losses in the dielectric are emphasised by Table 2; at the highest voltages expensive impregnating oils of special quality are used and the power factor of the insulation is maintained at all temperatures at a level of the order of 0.003-0.004. For 275 kV and 380 kV cables, a power factor of 0.0025 is desirable to minimise the dielectric losses and, if the dielectric power factor of such cables could be reduced to 0.002, an important increase in the power capability of the cable would result. Further increases in cable

rating will result from reduction in the dielectric constant of the insulation.

The author's thanks are due to Mr. J. L. Egginton, Chief Transmission Engineer, Central Electricity Generating Board, for permission to publish this article.

#### REFERENCES

- <sup>1</sup> Haldane, T. G. N. "High Voltage Transmission in Great Britain." Proceedings of the First British Electrical Power Convention, Torquay, June, 1949, p. 73.
- <sup>2</sup> Domenach, M. L. "Some Recent Aspects of Insulated Cable Technology." Bull. Soc. Fran. Elect. Vol. 7, pp. 285-299, May, 1957. "400 kV Cable." C.I.G.R.E. Paper No. 210, Paris, 1946.
- <sup>3</sup> Clark, F. M. Electro-Chemical Soc. Report 83, 6th April, 1943.
- <sup>4</sup> Murphy, E. J. Electro-Chemical Soc. Report, 17th April, 1943.

## LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

### Blanket Fires

I WAS most interested in your comments on the Fire Protection Association's report relating to the number and the causes of fires involving electric blankets (*Electrical Review*, 20th May). I note that the F.P.A., like so many other people, feel that the B.S.I. Kite Mark is a reasonable assurance of safety.

In my opinion the standards laid down in the present B.S. Specification are quite inadequate for consumer protection. Electric blankets manufactured in compliance with the B.S. carry the warning instruction that they must be switched off before the user goes to sleep. This indicates an inherent weakness in the standard of design and, in my opinion, electric blankets limited to these standards should not be in the bed at all as they represent a hazard to the user.

In addition to the risk of fire there is also the electric shock hazard which appears to have been ignored. It is interesting to note that in 1959, when the B.S. had been in force for some years, 10 per cent of all the electrical fatalities in the home were caused by electric blankets. Some of these were due to electric shock and the remainder to fire resulting from an electrical fault in the blanket.

You quote the F.P.A. figures for fires caused by electric blankets in 1950 and 1956, but a more startling fact is that in 1956 the total you have quoted represents 30 per cent of all fires in all buildings, that is industrial and commercial, in addition to domestic. There is ample evidence to show that there is no justification for complacency in this matter—must we have a public outcry and questions raised in Parliament as in the case of oil heaters before the consumer can enjoy the benefits of adequate safety standards?

An electric blanket can be and is in fact manufactured to higher standards than those laid down by B.S. Such a blanket designed to meet the fire and electric shock hazards is of the safe low-voltage type which, amongst other safety features, embodies a special heating element which gives warning of deterioration or damage. Blankets of this design would certainly eliminate most of the causes of fire referred to in the F.P.A. list and would have

eliminated the fatalities reported in recent years because they are safe to sleep on—a most desirable feature in cases of illness, and for invalids and aged people who must have warmth throughout the night.

If at least one manufacturer can produce an electric blanket to such high standards, why is it that the B.S. Specification is so inadequate? Is it because manufacturers of mains voltage blankets are so strongly represented on the B.S.I. Committee that their standards tend to conform with what they want to offer the consumer rather than to what should be offered in the public interest?

You attribute the underlying cause of many fires to careless treatment. This was also said of oil heaters, but adequate standards of design and manufacture can cater for most forms of misuse.

Great emphasis has been placed on the question of price in relation to standards of design, but many of the electric blankets on the market, although cheap, are very poor value for money. For example, many of the cheap "single-bed" blankets are of such dimensions that they cover only a third of the superficial area of a single-bed mattress and I consider that standards of size have not been laid down in the B.S. for the same reason that technical standards are also inadequate.

D. GRIFFIN.

### Floor Heating and Radiator Systems

MR. HARDINGHAM has made the most important point in this correspondence, namely, that electric heating of any sort must be sold on its merits and a disservice will be done to the electrical industry if comparative running costs are not mentioned.

In private houses, where some degree of continuous heat is wanted day and night, electric floor warming, on an off-peak tariff, can show a fairly good case in comparison with fossil fuels. Where intermittent warmth is wanted, convectors or radiators heated individually or by an electrode boiler can equally show a reasonable comparison in operating cost with other fuels.

In an office building, when considering the heating for eight hours a day, neither off-peak electric floor warming



nor on-peak electric heaters can come within a reasonable comparison to other fuels, the comparison in operating costs being between 2 and 3 to 1 in favour of oil.

Electric heating of office buildings by hot water thermal storage can, in many cases, show a comparable operating cost to oil firing and it has been proved by many existing installations of both types.

It would be impossible in the limited space of this letter to set out the data justifying the above statement, but I had the opportunity of presenting it in a paper to the Institution of Heating and Ventilating Engineers last December, and I should be very glad to send details to anyone interested.

*Harrow, Middx.*

S. A. WILLIAMS,  
Managing Director,  
Bastian & Allen, Ltd.

READING through the correspondence which you have published under the above heading, I am surprised at the number of assertions which have been made which have been unsupported by any evidence.

For example, in his letter published in your issue of 27th May, Mr. C. L. Champion says "the vagaries of the British climate do not help the case for off-peak heating of this kind." If Mr. Champion had been involved in the rise and development of this enterprise, he would have known that the vagaries of the British climate have contributed considerably towards its success.

In the same letter Mr. Champion says "I believe that a very critical investigation should be made before contemplating any major scheme of electric floor warming." This statement is really a reflection upon the competence and integrity of those people in the electrical industry who have been engaged in the development of this particular form of electric heating from its inception. The fact is that continuously from the beginning critical investigation, examination, test, comparison and analysis have been consistently pursued, and every effort has been made to extract all the information that can be obtained.

In your issue of 10th June Mr. C. T. Hardingham says "The running costs of a heating system using electricity are certainly higher than a system using solid fuel or oil." Is Mr. Hardingham's statement based on acceptable evidence, or is this another unsupported assertion?

*Elton, Peterborough.*

L. HOULDRIDGE.

ALL will agree that there is obviously a lot of interest in this subject if the correspondence is anything to go by. Some agree—some disagree about the points made. The fact that there is this interest—the fact that there is this difference of opinion should lend support to my plea for field tests. I have drawn attention to unbiased research work which indicates that radiator systems use less fuel. No one has produced any evidence to the contrary.

Personal opinions will get us nowhere. Field tests, whilst admittedly not 100 per cent accurate, can provide sufficient evidence to be of real value to local authorities, speculative builders and others anxious that the householder should enjoy the benefits of the highest standard of comfort with the lowest operating cost.

I do not claim to be an expert in domestic heating,

but I have discussed this subject with experts in America, in Europe and Scandinavia. All agree that:—

(1) The system should be as flexible as possible.

(2) The heat emitter should provide its heat by radiation and convection.

(3) It should have a low surface temperature (safe to touch).

(4) It should provide the minimum difference in temperature between floor and ceiling and across the space being warmed. (In other words, deal effectively with the window problem.)

Electricity can meet all these requirements. It is perhaps the easiest and certainly the cheapest to control by thermostat, relay and time switch. Thermostats and time switches can ensure a good diversity between heat emitters with the minimum contribution to the peak. Electric heat emitters exist which meet the other requirements.

Obviously, there is room for almost every form of continuous space heating but it is important that there are data available comparing one form of heating with another under like conditions. It does help to ensure that the customer receives reasonably unbiased advice.

*London, W.1.*

A. C. HAZEL,  
Managing Director, Hurseal, Ltd.

### Football Pitch Anti-Frost Installation

IN your issue of 3rd June (page 1079) you state that the electric wiring installed at the Everton Football Club's ground two years ago has interfered with the drainage of the ground in wet weather.

It must be pointed out, however, that this statement is misleading, damaging and incorrect, as the real trouble was caused by consolidation of the ground before the cables were laid in position and this prevented water from draining away in wet weather. In order that the drainage can be corrected, the cables have been taken up and will not be re-installed until the drainage is proved to be satisfactory.

Apart from the bad drainage, this pioneer Calidec electric snow clearing installation was satisfactory in every way and it may be recalled that in January, 1959, when all other important matches were cancelled because of snow and frost, the ground at Goodison Park was in playable condition and the game proceeded before a record attendance.

*Solihull, Warks.*

ARTHUR GOODMAN, D.F.H.,  
Managing Director,  
Calidec, Ltd.

### Automatic Control Course

A WEEK'S residential course is to be held in the University of Nottingham from 12th to 16th September on "Measurement for Automatic Control." The object of the course is to provide an introduction to the principles of measurement and to survey industrial applications of automatic control systems. No formal academic qualifications are required for enrolment but the lectures have been designed for people of degree or higher national certificate standard. Accommodation is limited and registration forms can now be obtained from the Organising Secretary, Measurement for Automatic Control Course, Faculty of Applied Science, University of Nottingham, University Park, Nottingham. The fee for the course will be 12 gns, excluding accommodation and meals.

# National Inspection Council

## GEOGRAPHICAL SURVEY OF RESULTS

By W. G. S. THOMPSON, O.B.E.\*

It should be noted that in this article the author deals only with applications for enrolment received since the Roll of Approved Electrical Installation Contractors was instituted. At the inauguration of the scheme all members of the two Electrical Contractors' Associations, the installation departments of the Electricity Boards, and contractors on the former National Register of Electrical Installation Contractors were automatically enrolled unless they "contracted out." The fourth edition of the Roll contains just under 4,000 names and 5,380 addresses

**I**N the issue for 5th February last the *Electrical Review* published an article reviewing the first three years of operations of the National Inspection Council for Electrical Contracting and gave a broad picture of what it had achieved to date. As the fourth edition of the Council's Roll of Approved Electrical Installation Contractors has recently been published, it may be of interest to readers to examine the concrete results, as exemplified in the number of approved contractors now appearing in the geographical section of the Roll.

The fourth edition contains the names of 254 new applicants who have been approved for enrolment since the third edition, and during the same period 124 contractors have been removed, mainly owing to the firms going out of business altogether or giving up electrical contracting work. Table 1 shows the number of applications received, the number of applications approved, and the number of removals year by year since the Council came into existence in the autumn of 1956:—

TABLE 1.—APPLICATIONS, APPROVALS AND REMOVALS

Period	No. of applications received	No. of applications approved for enrolment	No. of removals
1956–31st March, 1958	321	144	26
1/4/58–31/3/59	225	245	192
1/4/59–31/3/60	254	254	124
TOTAL	800	643	342

It should be mentioned that the fact that the figure of 254 for the number of applications received is the same as that for the number of applications approved for enrolment in the year ended 31st March, 1960, is purely a coincidence. At the end of each year there is inevitably a lag of recently received applications which have not been dealt with, as well as a number of applications which have been deferred for a period pending a second inspection, and a number, nearly 10 per cent of the whole, which have been rejected as not being up to the required standard.

The large number of removals during the year 1958–59 should be looked at in conjunction with the very small

number before 31st March, 1958, when the Council had not had time to get its procedure organised for checking on firms who were no longer carrying out installation work. Even so, the wastage figure over the last two years is high, due at least as to 80 per cent to firms either closing down or ceasing to do installation work.

Apart from this, the only other comment is that the number of applications received has remained fairly steady, with a slight upward trend in 1959–60. Saturation point is obviously far off. Indeed, indications are that the upward trend is accelerating, the number of applications received at our head office between 1st January and 25th May this year totalling 160. During the same period 195 requests for application forms have been received at head office, in addition to which over 250 application forms were handed out at the Electrical Engineers' Exhibition to callers at the N.I.C.E.I.C. stand. All these figures are higher than for the corresponding period in previous years.

Progress has been by no means uniform throughout the country. Table 2 shows various areas taken at random, indicating this fact quite clearly. The column showing approximate population is included as some indication of the relative size of the areas included in the table.

It must first be pointed out that the *net* increase takes

TABLE 2.—ANALYSIS OF PROGRESS

Area	Number of names and addresses of approved contractors contained in		Net increase	Approx. population (million)
	1st Edition, April, 1957	4th Edition, May, 1960		
London	351	407	56	6.1
Lancashire	501	567	66	5.1
Yorkshire	409	500	91	4.7
Scotland	622	789	167	5.2
including				
Glasgow	109	124	15	
Edinburgh	70	73	3	
Northumberland	75	107	32	1
Warwickshire	136	163	27	1.930
including				
Birmingham	92	106	14	
Staffordshire	122	166	44	1.7
Derbyshire	38	48	10	0.9
Leicestershire	37	58	21	0.7
Lincolnshire	72	89	17	0.6
Northamptonshire	41	50	9	0.5
Nottinghamshire	49	67	18	0.9
Cornwall	48	62	14	0.3
Devon	108	137	29	0.8
Dorset	30	41	11	0.3

\* Chief Executive Officer and Secretary, National Inspection Council for Electrical Contracting.



account of the removals from the Roll, so that the actual number of new enrolments in an area equals the net increase, plus the number of removals. As the removals have been spread fairly evenly over the country, the gross figure of new enrolments has not been given. It does not really affect the actual growth of influence of the N.I.C.E.I.C.

A second point to note is that the somewhat high net increase of 167 names and addresses in Scotland is explained in part by the fact that the fourth edition includes just over 90 service centres, showrooms or branches of the two Scottish Electricity Boards which were not listed in the first edition. Even allowing for this, however, an increase of over 70 approved contractors in Scotland, of whom only 18 are in the two major centres of Glasgow and Edinburgh, shows a gratifying interest in the work of the National Inspection Council over the country as a whole.

### Yorkshire's Lead

London does not show up well by comparison either with Lancashire, Yorkshire or Scotland. Yorkshire shows the largest net increase in England and Wales, and this increase is likely to rise appreciably again this year, following the decision of the West Riding County Council to employ none but approved contractors for their work. This has already brought in 25 applications from the West Riding since the beginning of March, and very many more requests for application forms have been received. Yorkshire is, of course, a very large county, and there are still parts, particularly in the North Riding, where the number of approved contractors is depressingly small. Less than 40 per cent of contractors applying to the North Eastern Electricity Board for connection of new supplies to the mains in the North Riding are enrolled with the N.I.C.E.I.C.

In Northumberland, by contrast, out of the total number applying to the Board for new connections, nearly 65 per cent are approved contractors. The reason for this high proportion is clear. The North Eastern Electricity Board, in the areas previously served by "Nesco," gives installation work on sub-contract to selected contractors in the area. Almost as soon as the National Inspection Council was inaugurated in the autumn of 1956, the Board let it be known that in future it would add no contractors to its list who were not enrolled with the N.I.C.E.I.C., and that its policy would be gradually to use only approved contractors. This accounts largely for the increase of 32 approved contractors in the fourth edition as compared with the first edition and, indeed, the figures of increase are really higher than this, because out of the first 26 applications for enrolment which were received in time for the inspections to be carried out, the applications approved by the Board and the names included in the first edition, between 15 and 20 came from Northumberland.

A rough estimation made with the help of the London Classified Telephone Directory indicates that only about 34 per cent of all firms of electrical contractors or electrical engineers in the London area are approved contractors. The percentage, of course, varies within districts. For example, in the S.W.1 district, with 28 approved contractors out of 46 in the Directory the percentage is nearly 60. In the Wembley/Raynes Park

area, on the other hand, the percentage appears to be less than 10.

In the Midlands, the Birmingham Corporation has always been selective in the firms which it includes in its own list for electrical contracting work, and it is believed that this list is now compiled very largely from the N.I.C.E.I.C. Roll. In Staffordshire, there are no fewer than five local authorities which invite tenders only from approved contractors or members of the Electrical Contractors' Association. This is undoubtedly the reason for the comparatively high increase in the number of approved contractors in that area.

The five counties listed in the East Midlands taken together have a population very much the same as the combined population of Warwickshire and Staffordshire, and in the fourth edition of the Roll the number of approved contractors in the area is 312 compared with 329 in Warwickshire and Staffordshire, representing an increase of 75, as compared with 103 since the issue of the first Roll. The figures for Lincolnshire are outstandingly better than those of the other counties, although the increase is roughly the same for Lincolnshire, Leicestershire and Nottinghamshire. These three counties have between them six local authorities which are giving preference to approved contractors for their electrical contracting work, whereas in Northamptonshire and Derbyshire there is, so far as is known, none.

Turning to the south-western counties, three local authorities are known to give preference to approved contractors in Somerset, in addition to the Bristol Corporation and one in Dorset; but there is none in Devon and Cornwall. In proportion to population the total number of approved contractors in these four counties (342) and also the increase since 1957 (76) are appreciably higher than those in the East Midlands. This is probably due, at least in part, to the very active support and encouragement given to the N.I.C.E.I.C. both by the South Western Electricity Board and the South Western Electricity Consultative Council from the very beginning. The East Midlands Consultative Council has recently taken a great interest in the activities of the Council, and this interest can be expected to produce results in the near future.

### Value of Local Interest

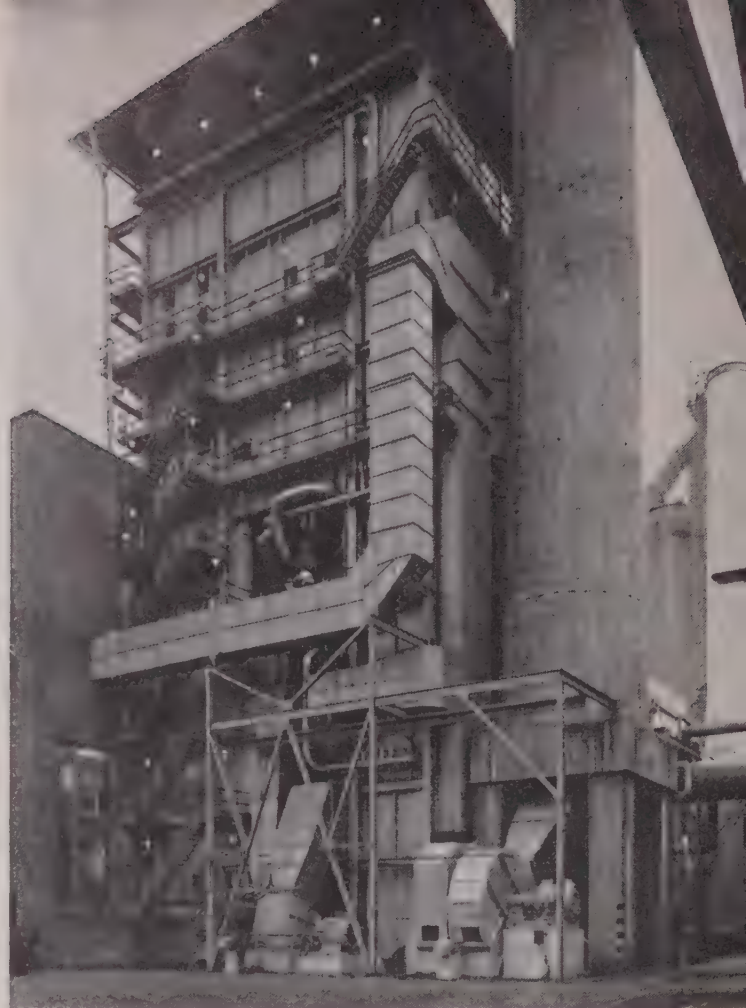
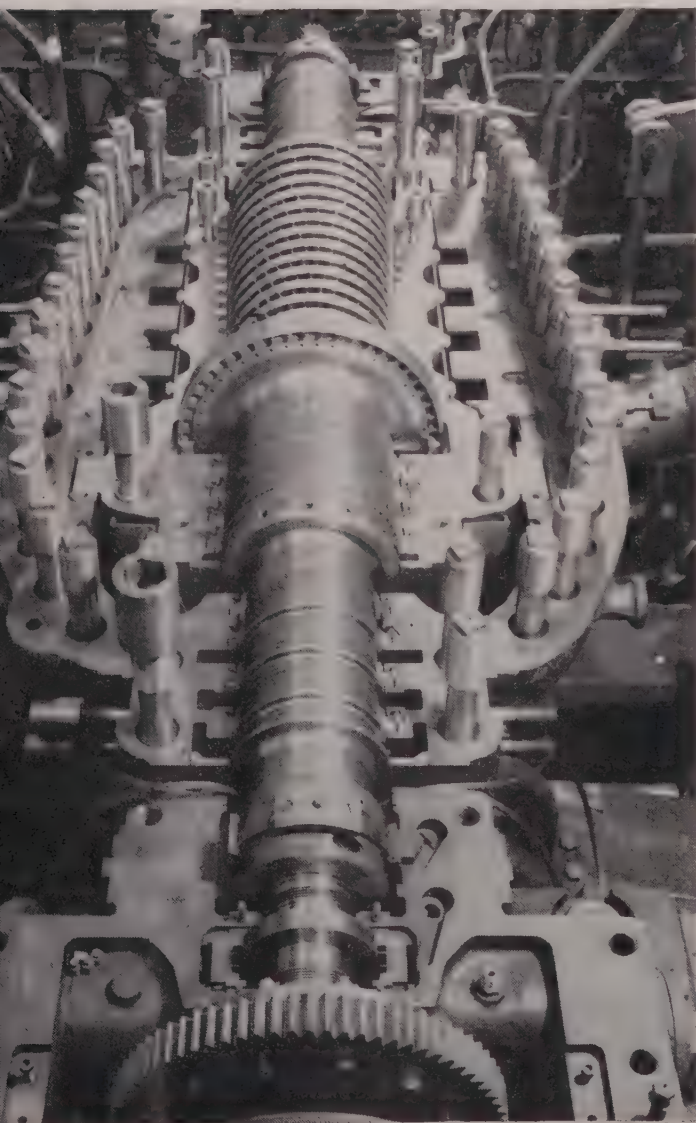
To sum up, it is obvious that the N.I.C.E.I.C. has achieved the best results where there is local interest, and it seems equally certain that the most influential local interest is that of local authorities. If they lead the way, the private consumer is naturally far more likely to pay regard to the advantages offered to him by the N.I.C.E.I.C. and its Roll of Approved Contractors in connection with his installation. The influence of the Consultative Councils, exercised perhaps mainly through their local committees, is primarily through their contact and influence with the local authorities. Regarding the effect of Electricity Boards themselves, Sub-Area or District officers can probably do more in their localities than can be done by someone at the Boards' headquarters; the influence of Board Headquarters is usually through Sub-Areas and Districts rather than direct.

The figures quoted in this article are only samples, and although the names of certain Electricity Boards and Consultative Councils have been mentioned, this does not mean that others have not been equally co-operative.



# 'Once-Through' Super-Critical Boiler and Turbo-Generator

A 240 klb/hr Benson boiler, with steam outlet conditions of 3,300 p.s.i. and 1,060°F, and a 9.5 MW back-pressure turbo-generator have recently been installed at the Margam Works of the Steel Company of Wales. The steam conditions at the turbine stop valve are 3,000 p.s.i. and 1,050°F



Above: The Benson boiler at the "B" power station at the Margam Works. Left: The 3,000 p.s.i. turbine rotor during construction at the makers' works

AS boiler operating pressure is increased, the difference between the densities of steam and water decrease. Consequently, the use of higher pressures in modern power station boilers has focused more attention on forced circulation systems. At present, steam temperatures are limited for metallurgical reasons to about 1,100°F but steam pressures have been steadily increased.

If the containment pressure is raised, the boiling point of the water rises and the quantity of latent heat required to change a given weight of water into vapour decreases. At a pressure of 3,000 p.s.i., water boils at 695°F, but at 3,200 p.s.i. it immediately flashes into a gas at 705°F without the addition of latent heat during "boiling." It is thus possible to provide superheated steam from water without passing through the wet vapour stage by first increasing the pressure above the critical point of 3,200 p.s.i. and then heating above the critical temperature of 705°F. The use of higher pressures in boilers increases the efficiency of the unit cycle. At pressures above the critical, boiling does not take place, and no steam release surface or drums are required. But, at critical pressure and temperature, water and steam have the same density, and it is, therefore, essential to provide a forced circulation system.

A super-critical boiler has recently been installed at the Margam Works of the Steel Company of Wales and last Monday the Minister of Power, Mr. Richard Wood,



paid a visit of inspection. This Benson boiler, which is an extension to the Margam "B" power station, has a "once-through" forced circulation system. It will be used to power what is believed to be the highest pressure turbine ever manufactured in Britain. This back-pressure turbo-generator, built by Richardsons, Westgarth, is rated at 9.5 MW with steam conditions at the turbine stop valve of 3,000 p.s.i., 1,050°F exhausting to 650 p.s.i., 670°F. Normally, 200,000 lb/hr of exhaust steam from the turbine will be discharged, after reheating, into the existing 650 p.s.i. system from which two turbo-blowers and an alternator are driven.

Because of its efficiency, it is intended to operate the boiler/turbine unit as a base-load set. To maintain it at full output, automatic fuel control is provided. This

ensures that a supply of fuel oil automatically makes up any deficiency in the normal supply of blast furnace gas. When it is necessary to alter the boiler/turbine load from its optimum setting, a manual load setter simultaneously varies the feed water and fuel flow to the boiler.

The Benson boiler, which was designed and built by Simon-Carves, Ltd., is a water tube type without a steam and water drum. The feed water is pumped into the boiler and is heated, evaporated and superheated in a single passage through a number of tubes in parallel. Some of the advantages of this type of boiler are the use of small bore, thin tubes with reduction in weight and lower cost. Scale formation is also minimised by the forced circulation. However, there are complications due to the necessity of special pumping plant, and elaborate protection devices and controls are required.

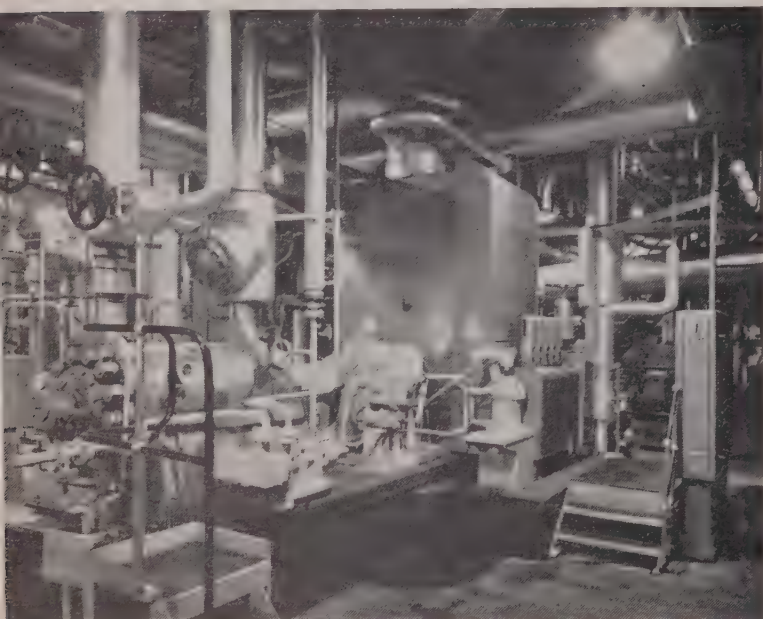
The boiler has a maximum continuous evaporative capacity of 240 klb/hr, the pressure and temperature of the steam at the superheater outlet being 3,300 p.s.i. and 1,060°F with a final feed temperature of 280°F. The quantity of steam returned to the reheater is 205 klb/hr and the pressures and temperatures at the reheater inlet are 650 p.s.i. and 675°F. At the reheater outlet, the steam is at 628 p.s.i. and 836°F. The output of the boiler can be obtained when burning either blast furnace gas with a calorific value of 92 B.T.U./cu ft at 32°F and 30 in Hg or fuel oil of 18,000 B.T.U./lb grade.

The boiler is arranged with four passes, each directly behind the other. The first pass comprises the combustion zone, the four walls of which form the radiant superheater. Above this is the first evaporator section, followed by the final convection superheater in two sections. Above the superheater is a further evaporator surface in three sections. In the latter surface is the transition zone where the change of state from water to steam takes place. The connecting tubes between the two sections of the final convection superheater are crossed, as also are the connection tubes between the second and third sections of the evaporator sections. The second pass comprises the reheater sections, arranged in parallel, each section comprising two banks of tubes. The third pass comprises the secondary economiser sections arranged in parallel, each section comprising three banks of tubes. The fourth or rear pass comprises the secondary tubular type air heater; the primary economiser sections are arranged in parallel, each section comprising four double-flow banks of tubes, followed by the primary tubular type air heater.

The total resistance of the boiler and superheater circuit is overcome by the K.S.B. feed pump delivery head, and this governs the final steam pressure. The variation in this delivery head, by the feed throttle valve, gives the facility to operate at less than the design pressure, which is an advantage in starting up the main turbine either from cold or hot.

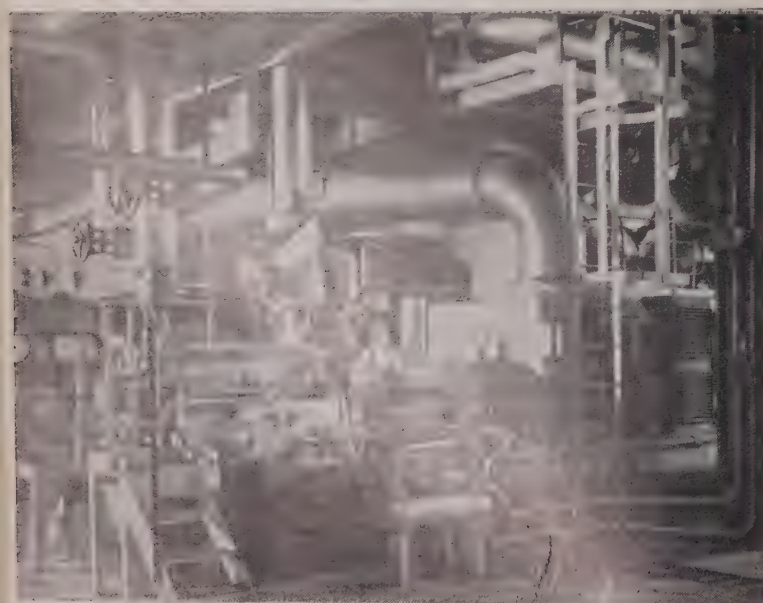
The firing rate is automatically matched to the rate of feed flow, and therefore the final steam temperature is governed by the firing rate with a trimming control from spray type desuperheaters, which form part of the boiler circuit. In this way, also by varying the firing rate, the steam to the turbine can be at less than design temperature, which is a further advantage in running up the turbine.

It is not possible to use a steam/air flow control for the



*The steam turbine-driven feed pump for the Benson boiler*

*The 11 kV Bruce Peebles direct-on start motor-driven feed pump for the Benson boiler. This 2,400 h.p. motor is capable of attaining full load in 5 seconds with a starting current less than 5 times full load*



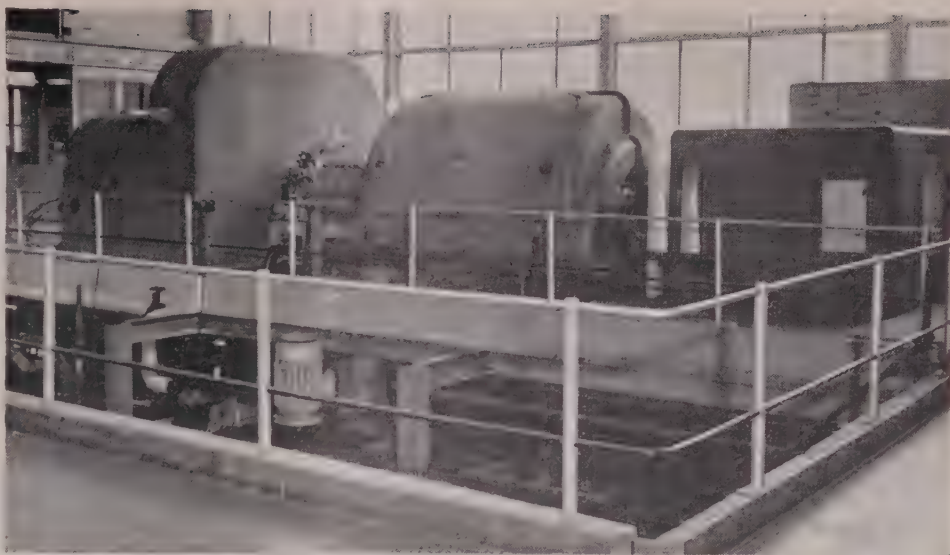


determination of combustion efficiency, as the quantity is different for each fuel. The method adopted is to measure the quantity of each fuel supplied to the combustion chamber and to control the forced draught fans to supply a total quantity of air equal to the sum of air required for each fuel.

Established practice for normal boiler/turbine plant, which cannot apply in this case, is for the generator output to be varied through the speed governor of the turbine while the automatic equipment of the boiler varies the feed and fuel input to maintain preset steam pressure. The turbo-generator at Margam is arranged for pressure governing (with overriding speed governing for safety), the boiler output being varied by an adjustable load setter on the boiler panel. The generator is then supplied with more or less steam according to the boiler output, the pressure being controlled by the turbine governor valves through an Askania relay unit. The feed pump output now controls the boiler load and the final steam temperature is dependent on the fuel/feed water ratio with final and more rapid trimming obtained by two stages of spray desuperheating.

The boiler can be operated fully automatically or automatically, in which case the valves, vanes, dampers, etc., are actuated by electric motors but controlled by switches operated by the boiler supervisor at the desk. On fully automatic control, the boiler output is adjusted by the load setter which consists of a series of rheostats driven by a pilot motor operated from the control desk. The rheostats send out immediate signals of load changes to the fuel controller, with delayed signals to the feed water

*The central control panel of the Benson boiler and the high pressure turbine at Margam*



*The 3,000 p.s.i. turbo-generator at Margam*

and steam temperature (spray water) controller. These signals are proportional to the required boiler conditions. The delay in sending out the latter signals ensures that, on a rising load, the combustion chamber does not cool too rapidly and conversely, on falling load, the fuel is reduced before the feed water.

The signal to the fuel controller is compared with the summation of signals obtained from potentiometers operated from flow meters in the blast furnace gas and fuel oil lines. These signals are proportional to actual conditions on the boiler. The difference of the two signals to the controller is the error signal which is amplified to operate the blast furnace gas and fuel oil actuators, hence altering the firing rate to bring the actual condition in line with the required conditions. Similarly, for feed water control, the signal from the load setter is balanced against a signal from the actual feed flow and the error passed via a magnetic amplifier to the actuator operating the feed flow regulating valve.

The h.p. steam temperature is regulated by injecting spray water in two stages. The valve on the first stage is controlled by a signal from the load setter which has been balanced against a signal of the measured temperature obtained from a thermocouple in the first stage desuperheater. The final desuperheater temperature is controlled by a spray valve in the second stage desuperheater.

The turbine is designed for an output of 9.25 MW when supplied with 240 klb/hr of steam at 3,000 p.s.i., 1,050°F and exhausting at 650 p.s.i., 670°F. The turbine rotor runs at 9,500 r.p.m., is 6ft 6in between bearing centres and weighs 1,300 lb. The turbine cylinder is of double-walled construction comprising an inner cylinder and flanged outer cylinder of 4½ tons total weight. The turbine rotor carries a single row of impulse blades welded to a disc turned on the rotor and this wheel is followed by 14 rows of reaction blading. All the reaction blades are machined from solid bar with integral shrouding and are welded together at the shrouding in packets of three or four. The 9.5 MW 3,000 r.p.m. generator is conventional with direct-coupled exciter. It generates at 11 kV with a p.f. of 0.7 lagging.



# WORLD POWER CONFERENCE

FROM OUR SPECIAL CORRESPONDENT IN MADRID

This year's Sectional Meeting of the World Power Conference was held in Madrid from 5th to 9th June. The general theme of the meeting, "Methods for Solving Power Shortage Problems," was chosen in view of the universal desire to increase the traditional sources of power, or to replace them by other sources. It was not surprising, therefore, that nuclear power played a very prominent part in the discussions

AT the World Power Conference Sectional Meeting in Madrid last week some 160 papers were presented and delegates from 59 different countries took part. In view of the wide range of interests covered and the multiplicity of papers, the conference was classified into five main divisions and further sub-divided so that two conference rooms could be used at once, each covering rather different facets of the main theme. Because of the almost impossible task of reviewing all the papers submitted, certainly in an article of reasonable length, we have attempted mainly to review the British papers, highlighting the parts which would appear to be of most interest to electrical engineers in general. Altogether, 17 papers emanated from Great Britain, the largest group being devoted to nuclear energy.

## Energy Sources and Requirements

In the group which covered methods of investigation of energy sources and requirements, the first paper was presented by J. Henderson (chief engineer, South of Scotland Electricity Board) and C. L. C. Allan (chief electrical and mechanical engineer, North of Scotland Hydro-Electric Board). They dealt with energy sources and growth of consumption in Scotland and pointed out the remarkably consistent growth in electricity demand of 7 per cent per annum. The growth curve was shown from 1922 onwards and indicated that this trend may be expected to continue for many years. In 1958, about 68 per cent of the electricity was generated from coal, about 3 per cent at the nuclear station at Chapel Cross, 25 per cent from water power and the remaining 4 per cent was imported from England at off-peak times when the production costs there were lower than in Scotland. Oil was not used for electrical generation on any large scale, but there were some small diesel stations in the remote parts and islands of North Scotland.

In the winter of 1959, the total sent-out capacity of thermal power stations in Scotland was 1,660 MW, together with a hydro capacity of 990 MW. To cover the period up to 1966, it was planned to install a further 1,520 MW of capacity, this being made up of 580 MW of coal-fired, 360 MW of nuclear (Hunterston), and 580 MW of hydro plant. Of this last figure, no less than 400 MW would be accounted for by the new pumped storage plant at Loch Awe. This plant was estimated to cost only £38 per kW, excluding transmission to the load centres.

As for the years after 1966, it was likely that one large

coal-fired station would be built either on the east coast of Fife or on the south shore of the Forth estuary, about 15 miles east of Edinburgh. These sites would both be in the centre of new coal-mining developments, and the total cost of production would be likely to be between 0.525d and 0.545d per kWh. This assumed generating units of 200/300 MW each running at 75 per cent load factor, the whole station being estimated to cost £46 per kW. The construction of a further nuclear station would be deferred until about 1969, when the cost was likely to be more competitive with coal-fired plant. Good hydro sites were scarce and no great developments were expected.

It appeared that a shortage of coal would occur shortly after 1970 by which time nuclear generation should be competitive with coal. It was desirable therefore in the national interest to plan for further electricity generation on the assumption that all extensions to meet base load within a few years of 1970 would be nuclear. In conjunction with these, further development of pumped storage schemes would become necessary unless the load factor could be increased to at least 60 per cent.

A paper of considerable interest was presented by G. Armstrong (chief geologist, National Coal Board). His theme was the exploration for coal resources in Great Britain and he began by explaining that although prospecting was normally associated with relatively undeveloped countries, extensive prospecting was necessary for the economic development of new resources and the planning of new and reconstructed collieries.

Since nationalisation, more systematic and scientifically-controlled prospecting for deep-mined coal had been carried out than in the previous fifty years. The exploration had been directed to areas of most promise near to working coalfields and this policy had been proved correct by the fact that adequate resources of a range of coals of marketable quality had been verified adjacent to or within the present coalfields.

Although the full range of prospecting techniques was used in Britain, the boring method was most widely used. An interesting method was the use of sea-boring towers. Probably the first of its type in the world was launched in 1955 and proved the undersea extension of the East Scotland coalfield referred to in the previous paper. Another tower was at work off the coast of North Eastern England.

Perhaps the most surprising information revealed was the fact that an estimated 4,200 million tons of coal had



been proved since 1947, and in the same period, 16 new collieries had been sunk and 221 major reconstructions carried out.

H. J. Beard and A. W. Pedder (Merz & McLellan) spoke on the subject of forecasting electricity requirements. The authors began by stating the purpose of load forecasts, particularly in regard to the smaller systems which were in a relatively early stage of development. Extrapolation from statistics relating directly to the system or country concerned, direct inquiry from potential consumers and comparisons with events in other places were used, either singly or together, to help form a judgment.

In so far as European countries were concerned, the classical method of extrapolation based on the exponential, or compound growth, law still held pride of place. Without going so far as to regard it as an inexorable law of nature, it could be accepted as the mainstay of all forecasting in the five to ten years' term. The "ten-year doubling period" was an accepted feature of estimating in many countries where the rate of growth appeared to be steadily maintained at just over 7 per cent per annum.

On a very-long-term basis, study of actual loads showed a persistent falling-off of growth even though no form of saturation could be discerned and in some countries there was a tendency to turn to "regressive formulæ" for long-term forecasting. Whilst the so-called straight-line law used by some forecasters was of a regressive nature, something less drastic was required. The necessity to use some form of regressive growth formula was more important in the case of many of the younger systems. These often had annual rates of growth far exceeding the 6 to 8 per cent accepted in the well-developed countries. Even in these conditions, the law of compound growth was of great value in forecasting for short periods ahead, but for longer periods the estimated rate of growth should be tapered off in some way. The question was—How?

This, of course, was the difficulty, and the simplest way, often used, was to use an arbitrary reduction of, say, 1 unit per year on the load growth, e.g. the growth might be put at 20 per cent, 19 per cent, 18 per cent, etc., in successive years until some figure, such as 10 per cent, was reached. Other methods were described but it was pointed out that they were all equally arbitrary. Any of the methods described gave similar answers.

### Efficiency of Production and Utilisation

A paper on the development of large electricity generating units by E. S. Booth and the late J. W. H. Dore (Central Electricity Generating Board) brought the conference up to date with British practice in this field. Data made available by the purchase of some 13,000 MW of plant over a period of ten years suggested that where ratings were increased by natural evolutionary development, doubling the unit rating resulted in a reduction of the order of 20 per cent in the overall cost per kW of the installations. The combination of technological advances and improvements in manufacturing efficiency had resulted in real costs reducing at a rate of  $2\frac{1}{2}$  per cent per annum.

Thus, whilst it was apparent that there was scope for achieving further economic gains from higher steam conditions than the maximum British ones of 1,500 p.s.i., 1,050°F then designed (1954), it was equally apparent

that these economies were small in relation to those which might be gained from increases in rating and therefore maximum emphasis was placed on the exploitation of "size effect." The relative effects of thermal efficiency and size were remarkably demonstrated by a series of curves here reproduced as Fig. 1. The authors then went on to point out that the British electricity supply system was favourable to the use of large generating units, since the combined systems of the C.E.G.B. and the S.S.E.B. had a total installed capacity (1960) of some 27,000 MW, all heavily interconnected.

Other factors, however, were not so encouraging. The largest single component that could be transported by road was, in general, limited to about 160 tons. Whilst this limit could be exceeded if rail transport were used, the loading gauge imposed such severe dimensional restrictions that rail transport did not in fact provide any real alternative.

In recent years the decisive factor in this respect had been the limitation imposed on generator rating. Much effort had been concentrated on improving cooling techniques to increase the output achievable with a given weight of stator core and windings. The latest forms of inner cooling of rotor conductors together with direct water cooling of stator conductors had enabled a rating of 350 MW to be adopted for a single-line machine, and there was no apparent reason why further advances should not be achieved in the future. The ability of generator rotors to withstand the high torques imposed

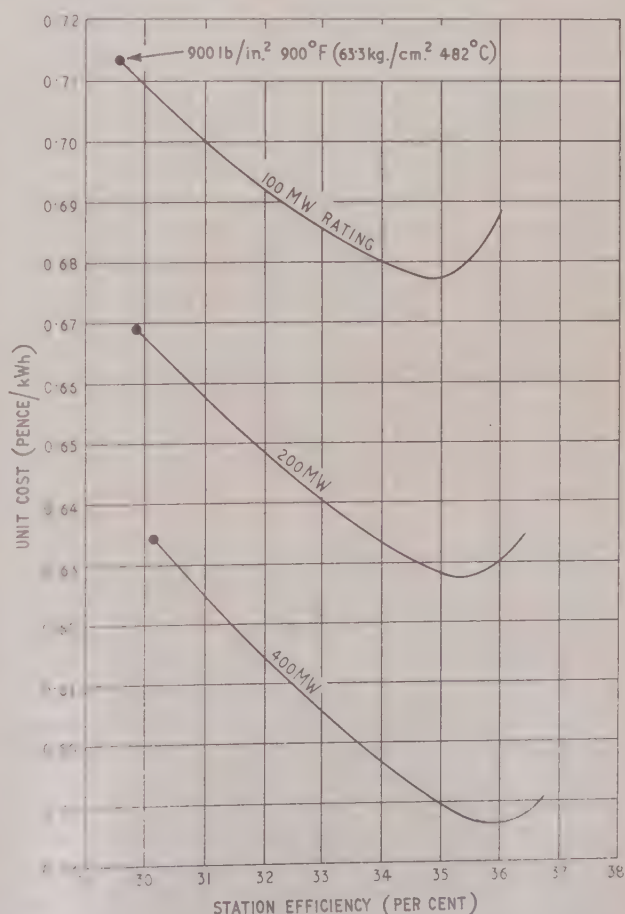


Fig. 1.—Variation of cost per kWh with thermal efficiency and unit rating



under short-circuit conditions and the maintenance of turbine alignment with the increased lengths of rotors were problems which the development of very large units had brought to the fore. Neither of these considerations appeared likely to become a limiting one for at least some time.

Boiler design considerations had not so far had any limiting effect on unit rating, but some caution was necessary in increasing the size of individual combustion chambers. There was much yet to be learned about the achievement of effective mixing of very large quantities of pulverised coal and combustion air. Increasing widths of furnaces also posed a problem in the provision of effective soot-blowing of convection passes.

In the discussions on this section, Philip Sporn reported that U.S. practice was going through a period of steam temperature stabilisation of not higher than  $1,050^{\circ}\text{F}$  rather than  $1,100^{\circ}\text{F}$ . Mr. Sporn went on to say that, in fact, present-day economics tended to favour plants with a turbine steam temperature of  $1,000^{\circ}\text{F}$  and this figure might well prevail for some time. It should be remembered, however, that the plants in question were utilising a double reheat cycle.

### Establishment of Nuclear Reactors on an Industrial Scale

Five British papers were presented in this section, and each of these papers is likely to be of interest to the electrical industry. A. G. M. Batten and G. F. Bullock (chairman and member respectively of the Advisory Committee of the British Insurance (Atomic Energy) Committee) set out to indicate the principal problems which the insurance of land-based reactors in Great Britain had brought to insurers, both from the point of view of material damage and third party risks. The problems could only be discussed within the terms of the law as it stands in the United Kingdom, and in 1959 the Nuclear Installations (Licensing and Insurance) Act was passed which placed all liability for damage caused by the escape of ionising radiations from a reactor upon the operator of the installation. Under this Act, operators (with the exception of Government Departments and the U.K.A.E.A.) would not be permitted to install or operate any nuclear project without having first obtained a nuclear site licence. The operator, however, was under no obligation to insure so long as he had, by some approved means, funds always available to cover liability up to £5 million. The State accepted responsibility in the event of a disaster causing that figure to be exceeded.

With regard to the insurance of reactors themselves, the authors dealt with the methods of covering the various kinds of risks and gave an indication of the factors taken into account by assessment of the engineering hazards and otherwise in arriving at their premium charges. Questions relating to insurance pools were considered and particular attention was paid to the class of insurance known as products liability insurance which dealt with liabilities of manufacturers of reactors and suppliers of parts or materials.

A paper by H. Cartwright (director of industrial power, United Kingdom Atomic Energy Authority) discussed some of the factors influencing the development of a nuclear power programme. In the author's view, careful long-term planning was essential if a fully integrated pro-

gramme were to be achieved, since a complex network of reactors and plants for fuel fabrication, chemical reprocessing, and uranium enrichment was involved. The auxiliary plants might or might not be in the country embarking on a nuclear power programme, but the overall economics of the entire system would determine the ultimate cost of power production and the electric power engineer should be well aware of these costs.

Fast reactors were currently thought to show most promise in reducing generating costs, but they had to be fuelled either with  $\text{U}235$  from a diffusion plant or with plutonium produced by other reactors. Reactors were therefore divided into three classes: first, natural uranium thermal reactors; secondly, thermal reactors using either uranium of low enrichment or uranium enriched with plutonium; and, thirdly, fast breeder reactors using highly enriched uranium or plutonium.

Examples of each type were given and programmes utilising them in various stages were analysed. The examples showed that thermal reactors with good neutron economy had a vital part to play in the future, and that a continuing programme of thermal reactor construction would be necessary even after fast reactors had been introduced.

A closely-reasoned paper on the economics of nuclear power in Great Britain was presented by Sir Christopher Hinton, F. H. S. Brown and L. Rotherham (chairman, deputy chairman and member for research respectively, C.E.G.B.). The authors commenced their paper by pointing out that until recently the electricity supply industry in Great Britain was a single fuel industry but the shortage of coal in the post-war years necessitated the use of oil as an immediate alternative with nuclear power as a long-term solution to the problem. The

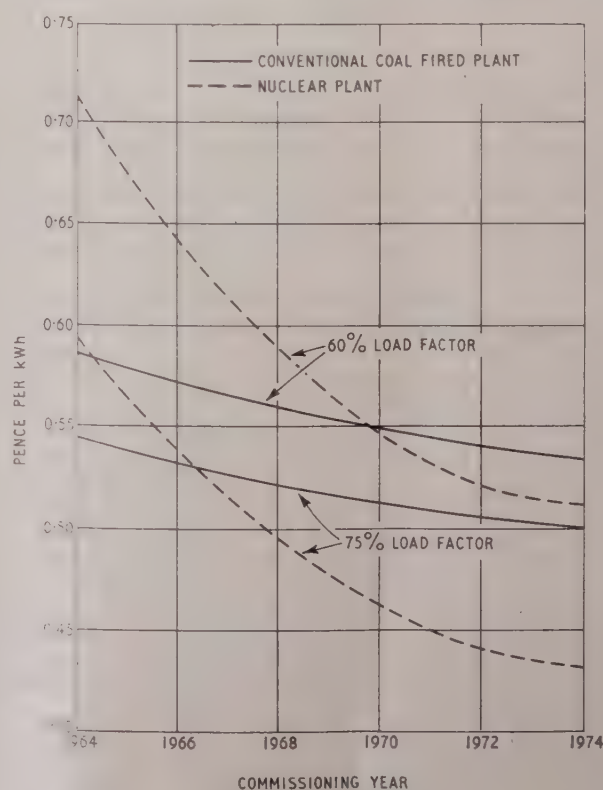


Fig. 2.—Nuclear and coal fired plant. Trends in generation costs compared



future planning of the relative uses of these three fuels required an examination to be made of the probable development of nuclear and fossil fuel-fired plant over the next decades.

The technical development in coal-fired steam generating plant in the last few years had been noteworthy. The trends of these developments and their extrapolation in the future was discussed, as was the probable availability and price of coal, and curves were given showing the anticipated costs of production from coal-fired stations at varying load factors up to 1975.

The existing designs of nuclear power stations would produce power at prices appreciably above those of conventional coal-fired plants. This difference was greater than was expected when the nuclear power programme was begun in the United Kingdom and the change was mainly due to the rapid technical advances in conventional plant. Another factor unfavourable to the use of nuclear plant was the slowing down in the rise of coal costs, a feature which was likely to persist.

Against this, there was no doubt that the capital costs of nuclear plant were falling at about the rate originally predicted and moreover it was probable that fuel costs would fall substantially. It was probable, therefore, that at high load factors the cost of power produced from nuclear and conventional plants would be comparable at some date between 1960 and 1970, and Fig. 2 illustrates the trend, these curves having been developed from cost curves of both conventional and nuclear plant given earlier in the paper. At this time, system operating factors would be becoming unfavourable to nuclear power but there would be a place for both types of installation in the electricity supply industry in Great Britain.

In the discussion, J. C. C. Stewart (U.K.A.E.A.) said that the Calder Hall plant had achieved an overall availability of over 80 per cent without the use of on-load fuel changing facilities. This demonstrated that this type of reactor was capable of availability comparable with that of conventional power stations.

### Training Nuclear Staff

The training of operating staff for the first British civil nuclear power stations was the subject of a paper by G. T. Shepherd (nuclear operations engineer, C.E.G.B.) and J. C. C. Stewart (deputy managing director, Production Group, U.K.A.E.A.). The paper described the influence of plant layout on staffing requirements, and showed how the early civil stations in Britain had been laid out in order to secure the best supervision of the important parts of the plant. The use of a central control room for the whole of a station was a great assistance towards safe operation.

Typical staff trees of both modern conventional and nuclear stations were presented and it was explained that the major difference lay in the provision of reactor technical staff and health physicists. After pointing out that nuclear power stations had many of the operating problems of conventional stations, the authors referred to the C.E.G.B.'s policy of appointing the majority of the operating staffs from conventional stations and giving them intensive theoretical training followed by attachment for some months to either Calder Hall or Chapel Cross. Considerable details of the training were presented, the system having been arranged jointly between

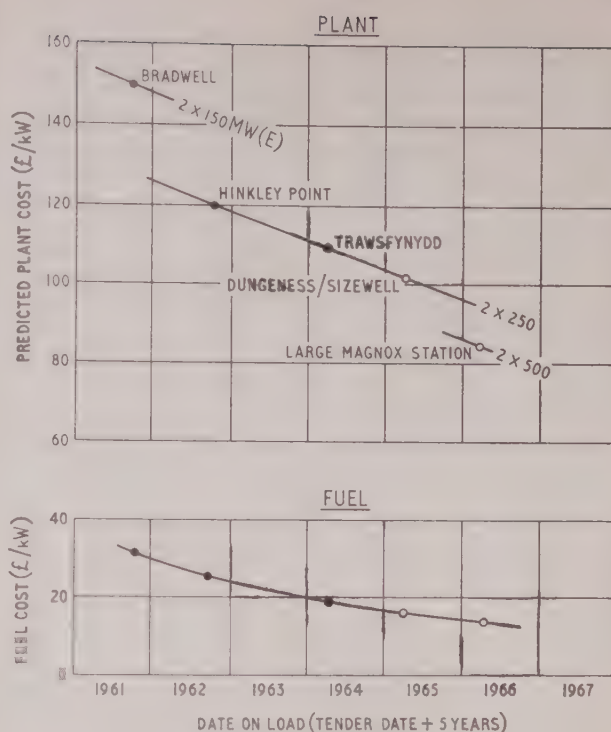


Fig. 3.—Reduction in plant and fuel costs with time

the U.K.A.E.A. and the C.E.G.B. After their own stations were commissioned, the C.E.G.B. would expect to obtain most of their senior operating staffs by promotion from the early stations, and to train the more junior staff in their own stations.

The importance of a reactor simulator was stressed. The C.E.G.B. had recently installed at the Berkeley nuclear power station what was probably the most comprehensive simulator of its type yet built. This was currently being used for training staff in reactor operation, and it was intended for the future that the simulator would also be used to re-test reactor operating engineers at regular intervals. Fault conditions of a great many types could be set up by the instructor in the course of "normal operation" and the operator's reactions tested. It was also possible to adjust the reactor characteristics both to simulate different reactors and to simulate changed conditions due to irradiation of fuel.

R. D. Vaughan (chief engineer, Nuclear Power Group) gave his views on the technical and economic development of the gas-cooled reactor. There were now under construction six nuclear power stations using gas-cooled reactors of U.K. design. Five of these were in Great Britain and the sixth in Italy. In addition, a contract had recently been placed for the building of a seventh station in Japan. All the reactors were similar inasmuch as they all employed natural uranium fuel elements of similar design working at comparable temperatures, and a similar layout of plant components. Whilst Berkeley and Bradwell were not due to come into operation until next year, it was already possible to see marked advances in the design of the later stations. Considerably increased knowledge had come from the actual manufacture of such important items as thick pressure vessels, expansion bellows, and control equipment.

Dungeness and Sizewell stations would have a



plant cost per kW about 30 per cent lower than Berkeley and Bradwell and this trend was shown in curves (Fig. 3). The most important technical factor leading to improvements in the economics of gas-cooled reactors had been the increase in gas pressure. The gains attributable to increase in gas pressure were extensive and included higher fuel ratings, reduction in the number of gas circuits, and improvements in thermal efficiency. A high gas pressure made it economic to use a higher reactor gas inlet temperature and, thereby, to overcome more readily the problems of Wigner energy storage in the graphite. At the same time, the steam conditions to the turbines were improved. All these improvements were reflected as a reduction in plant cost.

Several features, some more important than others, had contributed to the increases in gas pressure. First, there was plate thickness. Bradwell used 26-ton steel plate of 3in general thickness, reinforced in parts to 4in. On subsequent vessels plate thicknesses up to 4½in in 28-ton steel had already been handled satisfactorily, although this higher figure might be regarded as approaching the present technical limit. Secondly, there was the question of vessel operating temperature. Thermal insulation within the top part of the shell allowed higher working stresses to be used in the most difficult part of the vessel. Finally, there had been much better utilisation of the reactor vessel in regard to containing a graphite core of optimum dimensions. Good utilisation meant a smaller reactor vessel and, consequently, greater gas pressure for a given plate thickness.

Fig. 3 indicates that there has also been a 40 per cent reduction in the cost of the first charge of fuel due to improved fuel ratings and thermal efficiency.

Reactors of 250 MW (electrical) output were now being built and larger plants would be of interest only to countries with electrical distribution systems of very large capacity. A reduction of 10 per cent in specific capital cost would be achieved by doubling the output to 500 MW.

The generation costs with natural uranium reactors in the United Kingdom would fall to 0.5d/kWh by 1966. Within a year, it should be possible to forecast when the advanced gas-cooled reactor (A.G.R.) using enriched uranium oxide fuel would be in a position to compete.

### Inter-relation Between Conventional and Nuclear Power

One British paper was presented in this section and was by D. Clark, P. W. Cash and F. Faux (Planning Department, C.E.G.B.). The paper pointed out that the British nuclear power programme was decided on by the British Government in 1955, and it was clear that the bulk of the generating plant was to be installed on the system of the C.E.G.B. which covers England and Wales. Over 99 per cent of the Board's existing plant was thermal, most of it being coal-fired. Five nuclear stations totalling over 2,000 MW were already in hand (1960) for commissioning on the C.E.G.B. system in the years 1961 to 1964, when the total generating capacity would have risen to 35,000 MW.

Load density in England was high and transmission distances moderate, but the geographical situation of the coalfields caused the delivered cost of fossil fuel to vary over a range of nearly two to one. The 132 kV and 275 kV transmission systems provided full interconnec-

tion of all important power stations in order to pool spare generating plant and permit selective loading of stations according to fuel costs, thus concentrating base-load generation near the coalfields.

Capital costs of nuclear stations using natural uranium would be high, but fuel costs would be only about half those of the best coal-fired stations on the system; consequently, high utilisation of nuclear plant was both economically essential and justified. The annual system load factor was just under 50 per cent and the minimum load was about 12 per cent of the winter peak, but a study of load and plant characteristics suggested that nuclear capacity could approach 30 per cent of the total plant before the system imposed serious restriction on utilisation. The scope for base-loading nuclear plant might be extended if energy storage then proved economical.

The nuclear stations were being sited mainly in the south of England and would progressively supply more of the base load in these areas where delivered coal costs were high. Steam conditions for the nuclear stations were low and entailed high exhaust-heat rejections. Because inland water resources were very limited in England, most of the present nuclear stations had to be sited on the coast. The need for deep water close inshore, and for good foundations and other constructional facilities, narrowed the choice of site. Thinly-populated places were sought, to promote safety in the event of an accidental release of radioactivity. In one case, special arrangements were being made to protect public water supplies from any possible contamination. Much of the English south coast is fairly densely populated and considerations of town and country planning revealed objections to establishing power stations in many of the more remote places. Careful compromise was necessary and it was not easy to site the nuclear stations in the most convenient places for the transmission system. The 275 kV system had been laid out to link the major centres of load and generation, with especially strong ties between the coal-producing Midlands and the south of the country. As nuclear capacity grew in the south, the one-way power flow on these lines would diminish and they would serve to provide the added interconnection capacity made necessary by the increasing system loads and plant capacities.

Berkeley, the smallest of the nuclear stations, was being connected to the 132 kV system. The remainder were being connected at 275 kV, which over the distances involved would yield a circuit capability of 600 MW. The existence of the 275 kV system had facilitated the acceptance of large injections of nuclear power from coastal sites, the principal trend so far being to strengthen the east-west ties across the southern part of the country.

During the conference three special technical lectures were delivered, one of these, by Sir Christopher Hinton, being of considerable interest. In this lecture he traced the natural development of the British breed of reactor. He said that in the last seven years, techniques in the nuclear field had advanced more than conventional plant had in its first fifty to one hundred years. Naturally, some mistakes had been made and there were still honest differences of opinion as to the future.

The Calder Hall type of reactor was beginning to give way to the advanced gas-cooled reactor (A.G.R.) and this



in turn was likely to be replaced by the high-temperature gas-cooled reactor (H.T.G.C.R.). In the more distant future, heavy water might become the preferred moderator with steam as a coolant.

The United States had no fuel shortage and were blessed with cheap enriched fuels. They had developed reactors particularly suitable for powering submarines and it was natural for them to start electrical power generation with the pressurised water reactor (P.W.R.), and the need for higher temperatures had led them to the boiling water reactor (B.W.R.). As time went on, the U.S. might well find it expedient to separate the moderator and coolant. If this were so, we should see the U.K. and U.S. programmes converging to a common type, having started from very different points.

French conditions, in so far as nuclear power was concerned, were much closer to Great Britain than to

the U.S. and it was natural that they should follow a similar course. The U.S.S.R., on the other hand, were presumably closer to the U.S. These examples indicated that each country should use the means best suited to it. These means would differ, not only from country to country, but might even depend upon local conditions. Great Britain was a case in point where nuclear power stations were suitable for siting away from the coalfields. Success in nuclear power would be achieved only when it attracted no more headlines than coal or oil.

Power plant engineers had rightly been giving more attention to nuclear reactor design rather than to the ancillary plants. Fuel element production plants, diffusion plants and chemical separation plants were nevertheless vital links in the economic chain, and it was important that engineers in public utilities should watch costs in these ancillary plants.

## TELECOMMUNICATION MANUFACTURERS' REPORT

AMONG the sixteen countries with more than one million telephones, the rate of growth in new installations during the past ten years has been lowest in the United Kingdom. Ten of the countries have a bigger proportion of automatic telephones than we have. No improvement in the general position took place during 1959, but the trend was "rather better."

In quoting these figures in their annual report the Telecommunication Engineering and Manufacturing Association state that there is a "slight break in the clouds," and the White Paper on Post Office finances "may well prove to be one of the major steps in the progress of the telephone service in this country." But they view with some disquiet the provision for continuing Treasury control over investment. "Future telephone progress in this country will depend on whether these overriding powers are used only in an emergency and whether the Postmasters-General of the future display the necessary courage, foresight and business acumen for development to go full steam ahead in the interests of national efficiency."

The report records the continuing co-operation between the Post Office and industry in the design of electronic

exchanges, and the introduction by the Post Office of several new services for subscribers. Competition overseas is becoming increasingly severe and exports from this country of telegraph and telephone apparatus remained the same as in 1958. "It is in the country's interest to provide as big a home market as possible and to encourage new developments here, so that the advantages of mass production and the experience and 'know-how' become available to the industry as early as possible. Technically this country is well in the van of progress as is seen by the leading part it plays in long-distance submarine communication, for example, and we cannot afford to lose our place."

## Electrical Contractors' Conference

ON Sunday next members of the Electrical Contractors' Association and its allied organisations (the National Federated Electrical Association and N.E.C.T.A., Ltd.) assemble at Scarborough for their annual conference.

The first function is a "Get Together" on Sunday evening and at the business session on Monday morning the delegates will be welcomed by the Mayor of Scarborough and the president, Mr. V. J. Stock, will deliver his address. The annual general meeting will follow. In the afternoon there will be the customary social function. A reception by the Mayor, followed by a dance, will take place in the evening.

Two papers will be read and discussed on Tuesday. The first, in the morning, will deal with electric floor warming; the author is Mr. R. D. Jackson (Tyrad, Ltd.), who contributed a series of articles on the subject to the *Electrical Review* a year or two ago. At the afternoon session Mr. N. A. H. Stacey (G.E.C.), who has also written for this journal, will present a paper on "Retailing—the Future Pattern." The session will conclude with the installation of the new president, Mr. C. R. Waterhouse, who will give a brief address.

In the evening the president will hold a reception and there will be the customary dance.

## TRANSMISSION AND DISTRIBUTION CONVENTION

A THREE-DAY convention on electrical transmission and distribution will be held from 28th to 30th June at Enfield Technical College. Lectures on electrical transmission will be given by members of the staff of the Central Electricity Generating Board (Eastern Division) on 28th and 29th June, and on electrical distribution by members of the staff of the Eastern Electricity Board on 30th June. On each day there will be periods for discussion. Applications for enrolment are invited from practising electrical engineers engaged on electrical generation, transmission or distribution. The academic standard required is the H.N.C. in electrical engineering or its equivalent. The fee for the convention is £2 10s including luncheon and light refreshments. Applications should be made to the head of the Department of Electrical Engineering, Enfield Technical College, Queensway, Enfield.





# Les Grands Réseaux Electriques

## International Convention Opens in Paris

**T**HE eighteenth international conference on large electric networks, which is more generally known as C.I.G.R.E., opened in the Fondation Berthelot in Paris on Wednesday last, and will continue until Saturday, 25th June. At the opening ceremony the lecture theatre was packed to capacity and in fact many of the delegates had to stand. This ceremony took place on Wednesday evening, and on the following morning the technical sessions began with simultaneous meetings dealing with insulators and stability respectively. Today the delegates are due to discuss lightning and surges and direct current. During the next week the topics to be discussed will include cables, extra high voltages, transformers, overhead lines, towers, generators, relaying and circuit-breakers.

In view of the large number of delegates from different countries all over the world, the language problem has been overcome by the installation of simultaneous interpretation facilities and delegates can listen to the proceedings in English, French, German or Russian at will.

The more strenuous side of the conference will as usual be relieved by various social functions organised by the French hosts of the delegates. For instance, this evening there will be the traditional dance and garden party at the Cercle Interallié in the Rue du Faubourg-Saint-Honoré. It is very likely that early next week the French National Committee of C.I.G.R.E. will also entertain delegates at either the ballet or the opera. Next week, the Electricity Council, the Central Electricity Generating

Board and the Area Boards' delegation, led by Mr. and Mrs. C. R. King, are to hold a reception for delegates from other nations at the Maison de l'Amérique Latine. A number of visits of technical interest have also been arranged to take place during the conference, including the research and testing centre of Electricité de France at Fontenay, the Montereau thermal power station and 380 kV substation and the Champagne-sur-Seine works of Le Matériel Electrique S.A.

After the convention there will also be a number of visits of both technical and touristic interest.

In next week's issue we shall publish a detailed account of the first half of the proceedings of the convention.

### Aluminium Overhead Line Conductors

THE requirements of B.S. 3242 : 1960, "Aluminium Alloy Conductors for Overhead Power Transmission," are similar to those of B.S. 215 (which deals with aluminium and steel-cored aluminium conductors) but the new standard covers a range of stranded conductors made of heat-treated aluminium-magnesium-silicon alloy in sizes from 0.015 to 0.4 sq in copper equivalent. The specification was prepared at the request of the aluminium industry in view of the increasing use of aluminium alloy conductors for overhead power lines. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 4s 6d.



# INDUSTRIAL NEWS

## British Instrument Exhibition in Moscow

On 30th May the *M.V. Bardic Ferry*, of the Transport Ferry Service, cast off from Tilbury Docks bound for Antwerp carrying over 650 scientific instruments valued at £250,000 in five trailers for the forty exhibitors taking part in the exhibition to be held in Moscow from 18th to 29th June. The exhibition has been organised by the Scientific Instrument Manufacturers' Association of Great Britain and Sir Patrick Reilly, H.M. Ambassador to the U.S.S.R., will perform the opening ceremony.

The companies whose equipment will be on display are:—Airmec; Avo, Ltd.; Baird & Tatlock (London), Ltd.; Beckman Instruments, Ltd.; Cambridge Instrument Co.; Cossor; Dynatron Radio; Ekco Electronics; Dawe Instruments; Edwards High Vacuum; Electronic Instruments; Electrothermal Engineering; Elga Products; Elliott Bros. (London); E.M.I. Electronics; Evans Electro-selenium; Firth Cleveland Instruments; A. Gallenkamp; Griffin & George; Hilger & Watts; Labgear; Joyce Loeb; Courtney-Pratt; J. Langham Thompson; Marconi Instruments; Measuring & Scientific Equipments; Mervyn Instruments; Mullard Equipment; Nash & Thompson; Negretti & Zambra; W. G. Pye; Quickfit & Quartz; Racial Instruments; Rank Cintel; W. Bryan Savage; Sigma Instruments; Solartron Electronics; Stanton Instruments; Taylor, Taylor & Hobson; 20th Century Electronics; and Unicam Instruments.

## French Engineers' Visit

Engineers from Electricité de France have been visiting England at the invitation of the Electrical Develop-

ment Association to inspect installations on farms in the areas of the Eastern, the East Midlands and the Southern Electricity Boards. They have seen grain drying plants, grass dryers, electric poultry brooders and bulk milk tanks, and a film, "Current Affairs," and have also visited the Field Station at Shinfield.

## Domestic Refrigerator Sales

The April sales figures published by the Domestic Refrigeration Development Committee again reflect the strong demand for refrigerators this year. Sales of British-made domestic refrigerators in the home market totalled 119,565, as compared with 92,769 in April, 1959, an increase of 29 per cent. There was also an increase of 36 per cent in export sales over April, 1959. Approximately 19 per cent of United Kingdom households are now equipped with a refrigerator, compared with 17.5 per cent at 31st December last.

## Anglo-American Electronics Company

Further details of the recently-formed electronics firm, L.C.E., Ltd., have been announced. L.C.E., Ltd., is jointly owned by Joseph Lucas (Industries), Ltd. (through their subsidiary, G. & E. Bradley, Ltd.), and the Collins Radio Co. of America. The nominal capital of the new company is £100,000. The chairman of the board is Lord Halsbury, of Joseph Lucas (Industries), Ltd., and Mr. J. H. Lasley, of Collins Radio Co., of England, is vice-chairman. Much of the equipment produced by Collins will be available for manufacture by L.C.E., Ltd., who will receive development and technical assistance when required from the American

company. A sample range of the Collins-designed equipment, available for manufacture by L.C.E., was put on display for the first time in the United Kingdom at the May Fair Hotel, London, on 16th and 17th June.

## B.S.I.R.A. Extension

Work has commenced on the erection of a new 7,300 sq ft building at the headquarters of the British Scientific Instrument Research Association at Chislehurst, Kent. The building, which will comprise new workshops and mechanical laboratories, should be completed in the late autumn.

## Ultra Electric 25th Anniversary

Ultra Electric (Holdings), Ltd., celebrated its 25th anniversary on 9th June when it held a cocktail party at the Westbury Hotel, London.

The foundations of the present company were first laid forty years ago when the chairman founded the business of Edward E. Rosen & Co. The first products were headphones and loudspeakers and it was in these fields that the name of Ultra first became known. The business progressed rapidly, moving to larger premises in City Road within a year and to a factory in Harrow Road two years later. The first complete Ultra receivers were manufactured at Harrow Road and in 1925 the company was re-formed under the name of Ultra Electric, Ltd. The first all-electric Ultra receiver to be produced was made in 1930. The Western Avenue factory was opened twenty-five years ago—the year that the present company was established. During the past twenty years the activities of the company have extended into specialised fields of electronic equipment. The



Engineers from Electricité de France at Royston in the Eastern Electricity Board's area. Left to right: Mr. E. Claydon (E.E.B. agricultural engineer); M. E. Bastide (regional director, E. de F.); Mr. E. Holland (E.E.B. Sens Sub-Area); M. P. Chaumier (agricultural adviser, E. de F.); Mr. R. B. Richardson (commercial officer, E.E.B. Chilterns Sub-Area); M. J. Chazal (joint director, E. de F.); Mr. R. A. Bayetto (E.D.A.); M. J. Villeman (regional director, E. de F.); and Mr. W. Palmer (E.E.B. information officer)



expansion of this side of the company's business has led to a number of changes over the years. Research and development facilities of both subsidiary companies are being extended. Ultra Electronics, Ltd., has recently acquired 43,000 sq ft of factory space at Greenford and all pre-production and test equipment departments are moving into this new accommodation, thus permitting extension of the research laboratories at Western Avenue. Administrative staff of the Radio & Television company are moving to a new office block at Eastcote which provides 18,500 sq ft of space.

### Instruments for Power Stations

The Central Electricity Generating Board has ordered eighty specially accurate circular scale indicators to measure system frequency constantly. They will be installed in most of the major generating stations in England and Wales. Supplied by Honeywell Controls, Ltd., the instruments are known as the "Electronik" type. The frequency range covered is from 47 to 51 c/s to an accuracy of 0.01 of a cycle.

### Canadians Visit A.E.I.

The Prime Minister of British Columbia, the Hon. W. A. C. Bennett, paid a visit to the London headquarters of Associated Electrical Industries, Ltd., at Grosvenor Place, on 3rd June. With him were Dr. J. V. Fisher, his Economic Adviser and Co-ordinator of Provincial Finance, Mr. G. S. Bryson, Deputy Minister of Finance, Mr. E. M. Gunderson, executive vice-president of the Pacific Great Eastern Railways, Mr. G. D. Ekman, executive assistant to the Prime Minister, and

Major-General B. M. Hoffmeister, Agent General in London for the Province of British Columbia. During their visit they saw a number of models of A.E.I. products and were shown two films. One of these, "Another Name for Power," was made by A.E.I. and the other, "Power for Uganda," by Gateway Film Productions. Afterwards they met senior members of A.E.I. for discussions.

### Switchgear Manufacturers' New Factory

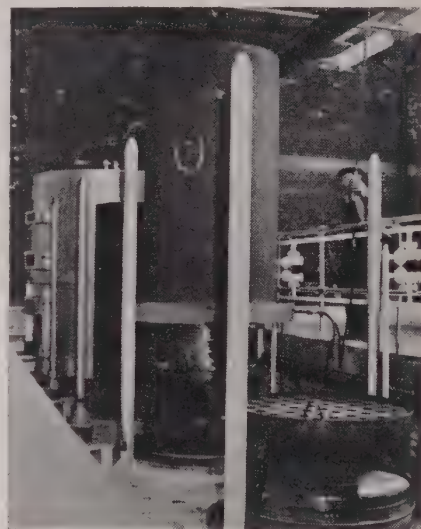
Engel & Gibbs, Ltd., have opened a third factory at Boreham Wood covering nearly 30,000 sq ft. The production area in this factory will be concentrated mainly on mercury switch relays and contactors up to 200 A. The manufacture of complete control panels will also be carried out in this building.

A development with which the company should be in full production during the course of the next few months will be a combination of its highly sensitive thermometers and mercury relays applicable for railway carriage heating, which is part of the programme of the reorganisation of the railways. Applications here are also going forward for de-icing of rail points and signalling control systems.

### Wire Annealing Furnace

A bell furnace installation for vacuum annealing copper wire has recently been put into operation at the Hazelhurst Works of F. D. Sims, Ltd., in Manchester. The plant, which was designed and supplied by the Electric Resistance Furnace Co., Ltd., uses a bell furnace transported by an electric travelling crane to serve six bases where the copper wire, in coils or

wound on reels, is heated in vacuum-tight containers. The bases accommodate a stack of wire up to 3ft diameter by 4ft high, with a maximum weight of about 3,500 lb. The wire is normally heated for four hours and then left to cool from twelve to twenty hours before being exposed to the atmosphere. The installation is designed to anneal 34 tons of wire in a work week of 120 hours.



Lowering a self-sealing hood over a charge of copper wire in the new annealing furnace installation

The furnace bell is rated at 85 kW and can operate at temperatures up to 550°C. It is heated by coils of nickel-chromium wire supported around the circumference of the chamber on sillimanite tubes and arranged in three zones, the temperatures of the zones being independently controlled with automatic indicating instruments. The furnace is accurately positioned over a base by guide posts and the electrical connections are made automatically.

### Anglo-Swedish Cable Laying

The British Post Office cables ship *Monarch* sailed on 7th June from Southampton to start laying over 500 miles of submarine cable linking the United Kingdom and Sweden, assisted by the smaller vessel *Ariel*. The new cable, the longest single two-way submarine cable yet laid, will come into operation in October and will have a capacity of 60 telephone circuits. Laying of the polythene dielectric coaxial cable and the 28 repeaters between Gothenburg and Marske, near Middlesbrough, should be completed this week. The British contractors for the repeaters, submarine cable and the repeater supervisory and terminal equipment are Standard Telephones & Cables, Ltd.; the Telegraph Construction & Maintenance Co., Ltd., supplied the land cable and the



Left to right: Mr. G. D. Ekman; Mr. G. S. Bryson; Mr. H. E. Wethered and Mr. R. L. Chantrill (directors, A.E.I. Export, Ltd.); Dr. J. V. Fisher; Mr. F. C. Gray (North American area manager of A.E.I. Export, Ltd.); Mr. E. W. Smith (joint managing director, A.E.I. Export, Ltd.); Major-General B. M. Hoffmeister; the Hon. W. A. C. Bennett; Mr. D. R. Love (director, A.E.I. Export, Ltd.); and Mr. E. M. Gunderson



Westinghouse Brake & Signal Co. were the contractors for the submerged repeater power feeding equipment.

### Refrigeration Merger

Merseyside Engineering (Refrigeration), Ltd., Liverpool, which markets the "Everest" range of refrigerators, washing machines and heating appliances, has merged with the German concern, Hans Liebherr, refrigerator manufacturers, crane and building equipment manufacturers. Merseyside Engineering states that plants are to be completed in Liverpool, North Wales and Scotland so that all "Everest" products will then be British made.

### French Porcelain Agreement

Steatite & Porcelain Products, Ltd., announces that an agreement has been concluded with the French manufacturers of electrical porcelains, Compagnie Générale d'Electro-Ceramique, for full technical collaboration, including exchange of patent rights. At the same time, Steatite & Porcelain Products have become selling agents in Great Britain for the products of the French company which will now represent Steatite & Porcelain Products in France. In this way, special ceramics and insulator designs from the French company will be made immediately available to the British market, until manufacture is established at Stourport.

### "Tar-Mac" Mixing Control Panel

A panel has recently been designed by Brook Motors, Ltd., to control the mixing of tarred-macadam. The basic materials used are ten grades of stone ranging from dust to 1½ in, filler, flux, three grades of binder and water. By using selector switches, process timers, weighing dials, flowmeters and batch

counters, any desired specification and total weight of material can be pre-set on the control panel before the operation is started by a single push-button. The whole of the desired quantity is automatically delivered and mixed in two ton batches. The process is indicated on an illuminated flow diagram on the panel. Some 30 Brook totally enclosed fan cooled motors, ranging from 1 to 70 h.p. with a total horse-power of 200, are employed on the plant.

### Transformers for the Admiralty

Brentford Transformers, Ltd., has received a contract valued at £67,000 from the Admiralty for 43 self-regulating 500 kVA transformers, with Statter circuit-breakers, type M.3, for shore-to-ship supplies in H.M. Dockyards.

### Computer Order

The Prudential Assurance Co., Ltd., has placed an order with Ferranti, Ltd., for an "Orion" data processing system to be installed at its chief office in London. With the associated punched card equipment, the installation will cost some £400,000.

### Cambridge House Modernisation

On the evenings of Wednesday and Thursday, 25th and 26th May, a total of more than 100 guests attended receptions held at Cambridge House, the head office and showrooms of the Cambridge Instrument Co., Ltd., at 13, Grosvenor Place, London. The receptions, held in the showroom and the new boardroom, were to celebrate the internal rebuilding and redecorating being carried out to modernise the company's recently entered premises. These will accommodate the staff necessary to deal with the additional business resulting from the present



At the Cambridge Instrument Co.'s reception. Left to right: Dr. G. B. B. M. Sutherland (National Physical Laboratory), Mr. H. C. Pritchard (managing director, Cambridge Instrument Co.) and Dr. P. Dunsheath (chairman)

expansion of research and production facilities. The visitors were entertained by members of the board of directors and the sales and publicity staff. Most of them were scientists and engineers representing industrial and research organisations.

### Electrical Industry in Austrian Broadcast

The British electrical manufacturing industry will be represented in the first joint broadcast to be arranged by the B.B.C. German Service and the Austrian Radio. The subject of the broadcast will be Anglo-Austrian trade and the problems of the "Six" and the "Seven." Mr. S. F. Steward, director of the British Electrical and Allied Manufacturers' Association, will take part in the recorded broadcast. The 60-minute programme will be broadcast by Austrian Radio at the time of the Foreign Secretary's visit to Vienna at the end of the month. It will also be broadcast by the B.B.C. German Service on the evening of 26th June. The title will be "Bridge over 1,300 km" (the approximate distance between London and Vienna).

### Vacuum Melting Furnace Order

The General Electric Co., Ltd., in association with Vacuum Industrial Applications, Ltd., and the British Geco Engineering Co., has secured an order, approaching £100,000 in value, from Jessop-Saville, Ltd., for the supply of an induction melting furnace of 1 ton capacity. This is believed to be the largest furnace of its type being manufactured in this country and it is scheduled for installation in the company's Brightside Works, Sheffield, by the end of the year. The furnace, which will operate at 1,700°C, is designed for semi-continuous operation and has provision for casting under vacuum. Bulk charging and alloy



Brook control panel for tarred-macadam mixing



addition can also be effected without breaking the vacuum. Power is to be supplied to the furnace at two frequencies, one of which will be used for heating, and the other for stirring the molten metal.

### Poznan Fair

A total of thirty-three British firms are taking part in a combined display organised in collaboration with the Board of Trade at the annual International Fair which opened in Poznan, Poland, on 12th June. Most of the exhibitors, several of whom represent groups of companies, will be in the British Pavilion, which covers 16,000 sq ft, but there will also be a British display outside, covering 22,000 sq ft. Distribution of space in the Pavilion and outside has been organised by the Board of Trade, which is also sponsoring a small display of British progress in nuclear power in the Pavilion. The British products on show will include electronic instruments and consumer goods such as vacuum cleaners.

### Japanese Engineers at Erith

Senior construction engineers of the Fuji Electric Manufacturing Co., Ltd., Japan, visited the Erith Works of the General Electric Co., Ltd., on 30th May in order to discuss reactor construction and design of the nuclear generating station being built at Tokai-Mura. This visit forms part of a tour which the party are making of several firms in the United Kingdom engaged in heavy engineering work. The Fuji Electric Manufacturing Co., Ltd., is acting as the main sub-contractor to the British General Electric Co. of

Japan, Ltd., for the Tokai-Mura project, and the visitors were shown a recently-completed model of the station.

### Overhead Line Contracts

The Associated Electrical Industries Construction (Cables and Lines) Division has received two further contracts for the erection of 275 kV overhead lines. The contracts, totalling over £360,000, have been awarded by the South of Scotland Electricity Board and cover two double-circuit steel tower lines with twin 0.4 sq in s.c.a. conductors per phase. One, from Strathaven to Wishaw, is approximately 7½ miles long and the other, between Strathaven and Neilston, approximately 19½ miles.

### Price Reductions

Reductions in the price of "Prestcold" commercial equipment are announced, with effect from 1st June. The "Vender" and "Retailer" open top sales cabinets will now be sold at installed prices of £144 and £148 10s respectively, instead of £159 and £164.

Etko-Ensign, Ltd., announces reductions in the prices of its "Essex" range of fluorescent fittings and accessories as from 15th June. Similar reductions are being made by Atlas Lighting, Ltd., operative from 15th June.

### Bridges' Export Conference

Plans for expansion in overseas markets were discussed at a recent one-day export conference at the new Battersea riverside factory of S. N. Bridges & Co., Ltd. Overseas agents who were in London for the official

opening of the Battersea factory by Lord Aberconway met Bridges' executives in the company's new demonstration room. Mr. G. N. Bridges, managing director, was chairman of the conference, and Mr. R. E. Kaan, export sales manager, outlined the export plans. Nine countries were represented at the talks with Mr. D. G. Bridges, financial director, Mr. S. R. Kilner, works and technical director, Mr. P. R. Davis, publicity manager, and Mr. R. P. W. Leek, general service manager.

### Trade Announcements

A new three-storey development has recently been occupied by Copperad, Ltd., Colnbrook, Bucks. The office block, covering 10,000 sq ft, is the third major building development to be undertaken on the Colnbrook site during the past year. In addition, a new factory extension providing 20,000 sq ft has been built, as well as a 2,400 sq ft space heating laboratory.

The association between E.M.O. Instrumentation, Ltd., and the Barden Corporation came into effect on 1st June, following the acquisition by Barden of a substantial interest in E.M.O. Quality Bearings, Ltd., who have been the Barden representatives in the United Kingdom, are being wound up and from 1st June E.M.O. has become the sole agent of Barden in Great Britain.

Jones, Stroud & Co., Ltd., are opening a new London office at 7-8, Market Place, London, W.1 (telephone: Langham 9488), on Monday next with Mr. D. J. Dowling, who was previously with Midland Silicones, Ltd., responsible for the electrical insulation side of the company's business.

Rhodes, Brydon & Youatt, Ltd., have moved their head office to their new Reddish Engineering Works, Stockport (telephone: Heaton Moor 6211).

Four new representatives have been appointed to the Sofono Electrical Division of Federated Foundries, Ltd. They are Mr. C. H. Tozer in the South East, Mr. N. F. Kirkland in London and the Eastern counties, Mr. F. R. Carpenter in the Midlands and Mr. A. Hilton in the North.

Pending the completion of new offices at Cromwell Road, Kensington, in 1961, the British Ferrograph Recorder Co., Ltd., is moving on 24th June to temporary offices at 88, Horseferry Road, Victoria, S.W.1 (telephone: Sullivan 5426/7/8).

R. B. Pullin & Co., Ltd., have appointed William Reay (Belfast), Ltd., to represent the thermostat division in Northern Ireland.



Left to right: Mr. P. A. Lindley (chief engineer, G.E.C. Atomic Energy Division), Messrs. M. Tominaga and T. Nakajima (Fuji Electric Manufacturing Co., Ltd.), Mr. T. Takehisa (Nissho Co., Ltd.), Dr. H. K. Cameron (manager, G.E.C. Atomic Energy Division), and Mr. T. Takaichi (construction manager, Fuji Electric Manufacturing Co., Ltd.), examining the Tokai-Mura model at the G.E.C. Erith Works





**DRAYTON SOUTHERN**

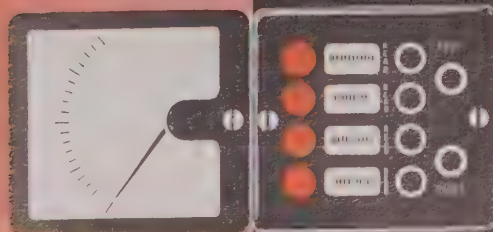
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# VIEWS on the NEWS

By "REFLECTOR"

MORE than once I have referred to the problems presented to the electricity supply industry by the enormous amount of ash produced in the pulverised-fuel firing of power stations. Often there is no accommodation for this material in the immediate neighbourhood of the station and it becomes necessary to transport it over considerable distances—by road or sometimes by pipeline, as a slurry. No wonder, then, that the Central Electricity Generating Board is constantly seeking for commercial uses for the ash. As I have mentioned, it is quite a satisfactory building material and it has also passed tests for road construction. One interesting development is the use of p.f. ash in the construction of the Trawsfynydd nuclear power station. In some sense this is in line with the traditional use of the fabric of ancient ruins in the building of new edifices, e.g. the Roman bricks from Verulamium in the Abbey Church of St. Albans. It might also be regarded as a contribution of the present "conventional" power station to its own doom.

\* \* \*

Cambridge University conferred the honorary degree of Doctor of Science upon Sir Christopher Hinton, the chairman of the Central Electricity Generating Board, last week. *The Times* reports that the Orator (Mr. L. P. Wilkinson) referred to Sir Christopher (in Latin) as

"the genius who had enabled the discoveries of the great atomic scientists to be put to the service of men. Cyclopean power stations were needed: he was the Vulcan who superintended the raising of those great piles and their equipment with most intricate machinery. . . . Calder Hall was his memorial, a token of the lead we still have in the peaceful application of atomic energy, which was also symbolised by the relentless strides with which he left his companions behind when roaming in search of sites."

\* \* \*

In 1899 the former *Cassier's Magazine* (now *Mechanical Handling*) published a special electric railway number recording the history and development of electric railways and tramways in the United Kingdom and abroad. The Light Railway Transport League (245, Cricklewood Broadway, London, N.W.2) is considering the production of a reprint of this issue, at a price of two guineas, and asks for support for the project. The notice which I have seen lists at the head affiliated societies in all parts of the world and I feel impelled to mention a few of them. There are three in the United States, including the

Central Electric Railfans' Association and the Electric Railroaders' Association; in Belgium and France there are Associations of Amis des Chemins de Fer; Germany has a Verband der Eisenbahnfreunde; and there is a Japanese Railway Friendship Association. With so many friends the electric railway (if not the tramway) should prosper.

\* \* \*

During the proceedings at the British Electrical Power Convention I heard no reference to Mr. J. W. Simpson who retired during the past year from the position of secretary of the Convention. Mr. Simpson had been responsible for a long series of Conventions, dating from the days of the former Incorporated Municipal Electrical Association, and it seems to me that the absence of any appreciation of his services was a singularly unfortunate oversight.

\* \* \*

My recent note on the mixed reception given to the metal filament lamp fifty years ago has drawn a reminiscence from Mr. Harry Moss, M.I.E.E., whose name will be familiar to many readers of this journal. He recalls that in about 1908, as manager for a Bradford firm, he obtained the order for lighting a large grocer's shop at Hanley, Stoke-on-Trent, and metal filament lamps were specified. This was, in fact, the first use of these lamps in the Potteries and the installation was connected only after the Corporation Electricity Department had at first refused to do so on the grounds that the lamps would not use enough electricity.

\* \* \*

From the *Electrical Review* of 15th June, 1880:—

"A suit has been brought in the Circuit Court at Madison, Wisconsin, America, to collect from an insurance company for damages done by the great storm of 1878. The property was insured against lightning, and the company resist payment on the ground that it was destroyed by wind. The plaintiff hopes to prove by the evidence of members of the Signal Corps that the whirlwind which destroyed his house was of electrical origin. A vast amount of insurance is likely to be affected by the decision of this case, owing to the heavy losses of property during the recent whirlwinds. General evidence of the electrical character of all tornadoes is found by Tice in the circumstance that, as a rule, they follow railroads and water courses, and either begin or expend their greatest energy upon them."





Mr. W. H. McFadzean  
(Knight)



Mr. C. Robertson King  
(K.B.E.)



Dr. T. E. Allibone  
(C.B.E.)



Mr. F. J. Erroll  
(Privy Councillor)



Dr. B. F. J. Schonland  
(Knight)



Mr. F. W. Bates  
(O.B.E.)

## BIRTHDAY HONOURS

The Birthday Honours List published last week includes the names of three well-known men in the electrical industry. **Mr. W. H. McFadzean**, C.A., Companion I.E.E., chairman of British Insulated Callender's Cables, Ltd., and president of the Federation of British Industries, has had a knighthood conferred on him. **Mr. C. Robertson King**, C.B.E., Companion I.E.E., M.Inst.F., chairman of the Electricity Council, becomes a Knight Commander of the Order of the British Empire (K.B.E.), and **Mr. T. E. Allibone**, Ph.D., D.Sc., F.R.S., M.I.E.E., F.Am.I.E.E., F.Inst.P., director, Research Laboratory, Associated Electrical Industries, Ltd., is appointed a Commander of the Order of the British Empire (C.B.E.). The names of other who have been honoured are given below:—

**Mr. F. J. Erroll**, M.P., M.A., M.I.E.E., Minister of State, Board of Trade, becomes a Privy Councillor, and knighthoods have been conferred on **Mr. B. F. J. Schonland**, C.B.E., M.A., Ph.D., D.Sc., Sc.D., F.R.S., Director, Research Group, United Kingdom Atomic Energy Authority, and **Mr. G. B. B. McL. Sutherland**, M.A., Ph.D., Sc.D., F.R.S., Director, National Physical Laboratory. **Mr. J. S. McPetrie**, Ph.D., D.Sc., M.I.E.E., Director-General of Electronics Research and Development, Ministry of Aviation, becomes a Companion of the Order of the Bath (C.B.).

New Commanders of the Order of the British Empire (C.B.E.), include **Mr. C. T. Meredith**, Director of Contracts, General Post Office, **Mr. R. A. Smith**, M.A., Ph.D., A.M.I.E.E., chief scientific officer, Royal Radar Establishment, Ministry of Aviation, and **Mr. J. C. C. Stewart**, B.Sc., A.Inst.P., deputy managing director, Production Group, United Kingdom Atomic Energy Authority.

The list of Officers of the Order of the British Empire (O.B.E.), includes

**Mr. F. W. Bates**, works director, Kelvin & Hughes, Ltd., **Mr. L. F. Broadway**, B.Sc., Ph.D., A.M.I.E.E., head of research laboratories, Electric & Musical Industries, Ltd., **Mr. R. J. Clayton**, M.A., A.M.I.E.E., manager, Applied Electronic Laboratories, General Electric Co., Ltd., **Professor A. L. Cullen**, Ph.D., M.I.E.E., Professor of Electrical Engineering, University of Sheffield, **Miss Mary Dilys Glynne**, principal scientific officer, Rothamsted Experimental Station, Harpenden, **Mr. A. A. Smales**, deputy chief scientist, Atomic Energy Research Establishment, Harwell, **Mr. F. J. D. Taylor**, M.B.E., B.Sc.(Eng.), M.I.E.E., staff engineer, Research Station, General Post Office, and **Mr. J. H. Sumner**, M.Sc., M.I.E.E., chief hydro development engineer, Central Electricity Board, Federation of Malaya.

New Members of the Order of the British Empire (M.B.E.) are **Mr. C. Boorman**, research manager, Capenhurst Works, Development and Engineering Group, U.K. Atomic Energy Authority, **Mr. J. H. T. Borland**, chief designer, Glenfield & Kennedy, Ltd., **Mr. W. J. Crooks**, production manager, Aberdare Cables, Ltd., **Mr. J. C. Gillott**, M.I.B.A.E., lately assistant chief commercial officer, East Midlands Electricity Board, **Mr. K. G. Lloyd**, chief export estimator, John Thompson Water Tube Boilers, Ltd., **Mr. R. McGlashen**, C.G.I.A., A.M.I.E.E., assistant commercial officer (industrial engineer), South of Scotland Electricity Board, **Mr. D. A. Neill**, director, Smart & Brown (Engineers), Ltd., **Mr. J. H. A. Pugh**, assistant engineer, London Telecommunications Region, General Post Office, **Mr. M. G. Smith**, divisional manager, Mechanical Automation Division, Elliott Brothers (London), Ltd., **Mr. C. V. Waddell**, electrical engineer, Cowans Sheldon & Co., Ltd., **Mr. J. R. Wight**, electrical manager, Scotts' Shipbuilding & Engineering Co., Ltd., **Mr. C. S.**

**Cassidy**, an electrical engineer, in charge of the Maseru Power and Water Supply, Basutoland, and **Mr. W. F. Coleman**, Deputy Director of Broadcasting (Engineering), Ghana.

The British Empire Medal (B.E.M.), has been awarded to the following:—**Mr. F. C. Ackerman**, foreman propeller patternmaker, J. Stone & Co. (Charlton), Ltd., **Mr. J. G. Anderson**, assistant foreman electrician, Vickers-Armstrongs (Shipbuilders), Ltd., **Mr. A. C. V. Baker**, foreman of model shop, E.M.I. Electronics, Ltd., **Mr. G. Baker**, foreman corebuilder, Associated Electrical Industries (Rugby), Ltd., **Mr. W. Cheadle**, leading stoker, Chadderton power station, C.E.G.B. (Oldham), **Mrs. Lilian May Cornwall**, senior chargehand, Electronics Group, Plessey Co., Ltd., **Mr. C. Crescimanno**, local electrical fitter supervisor, Admiralty, Malta, **Mr. S. Diamond**, electrician, Ministry of Works, **Mr. C. A. Green**, labourer, Eastern Electricity Board, **Mr. G. Kennedy**, control engineer, Dalmarnock generating station, South of Scotland Electricity Board, **Mr. W. E. Knowles**, technician IIA, Telephone Manager's Office, Gloucester, **Mr. R. H. Owen**, J.P., high voltage linesman, Caernarvon district, Merseyside and North Wales Electricity Board, **Mr. F. R. Pettyfer**, technical officer, Telephone Manager's Office, Bournemouth, **Mr. S. J. Pusey**, technician I, Kensington Telephone Exchange, General Post Office, **Mr. W. A. Reeves**, substation attendant, East Midlands Electricity Board (Boston), **Mr. G. A. Stewardson**, chargehand jointer (e.h.v.), North Western Electricity Board (Manchester), **Mr. G. Trantham**, general foreman, A.E.I.-Hotpoint, Ltd. (Llandudno Junction), **Mr. J. E. Tweddell**, chargeman, A. Reyrolle & Co., Ltd., **Mr. W. J. Whitby**, foreman, Rotax, Ltd., **Mr. S. F. Wren**, assembly shop foreman, Aish & Co., Ltd., and **Ng Ho Kong**, senior chargehand, Electricity Board, North Borneo.



# PERSONAL AND SOCIAL

## News of Men and Women of the Industry

**Mr. Alfred Robens, M.P.**, is reported to have accepted an invitation to succeed Sir James Bowman as chairman of the National Coal Board at the end of January next. Mr. Robens was Parliamentary Secretary to the Minister of Fuel and Power from 1947 to 1951 and later Minister of Labour. Earlier this year he became consultant on labour relations matters to Atomic Power Constructors, Ltd., the group building the Trawsfynydd nuclear power station.

The Minister of Power has appointed **Mr. W. B. Poulter** to be a member of the Southern Electricity Board with effect from 1st August next, while continuing to serve as a full-time officer of the Board. **Mr. Forbes Jackson, M.I.Mech.E., M.I.E.E.**, retires from the Board on 31st July on completion of his term of office. Mr. Poulter has been chief commercial officer of the Southern Electricity Board since its formation in 1948. Before nationalisation he was commercial manager of the Metropolitan Electric Supply Co.

On his retirement from the post of export director of the British Electrical & Allied Manufacturers' Association after twenty-two years' service with the Association, **Mr. D. Maxwell Buist** was presented by the staff with a deep-sea fishing outfit. The presenta-

tion was made by **Mr. S. F. Steward**, director of B.E.A.M.A., at an informal party at the Connaught Rooms, London, on 27th May.

The Central Electricity Generating Board, Southern Project Group, announces four new appointments.

**Mr. L. W. G. Mason, A.M.I.Mech.E.**, has been appointed resident site engineer for the nuclear power station to be built at Dungeness, in Kent. Mr. Mason, who entered the electricity supply industry in 1932, was formerly resident site engineer for Northfleet and before that was resident site engineer at Brighton "B" power station.

**Mr. M. V. Horsfield, A.M.I.E.E.**, has been appointed resident site engineer for Belvedere power station. He was formerly senior assistant (co-ordination) engineer for both Belvedere and Northfleet.

**Mr. A. Hanlon, A.M.I.E.E., A.M.I.Mech.E.**, has been appointed resident site engineer for Northfleet power station. He was formerly resident site engineer at Belvedere.

**Mr. S. F. Mogridge, A.M.I.Mech.E.**, becomes resident site engineer at Bankside "B" power station. He was formerly resident site engineer for South Denes.

**Mr. A. N. Irens, M.Sc., M.I.E.E.**, chairman of the South Western Electricity Board, and **Mr. S. Roberts**, managing director of Hoover, Ltd., have accepted Fellowships of the British Institute of Management.

Head Wrightson & Co., Ltd., announce the following appointments among their subsidiary companies:—**Mr. J. G. Allen** as managing director of Head Wrightson Steel Foundries, Ltd.; **Mr. G. Jones** to be managing director of Head Wrightson Stampings, Ltd.; **Mr. W. H. Mather** as managing director and **Mr. G. Gowthorp** as commercial director of the Head Wrightson Machine Co., Ltd.; and **Mr. T. H. Stayman** as managing director of Head Wrightson Iron & Steel Works Engineering, Ltd.

The Watford Electric & Manufacturing Co., Ltd., celebrates its diamond jubilee this year. To mark the occasion, all the employees with more than three months' service have been presented with a gift from the directors of the company. The value of the gift was in keeping with the length

of service of the employees and the presents ranged from fountain pens for those with short terms, to presentation clocks and hand-cut glassware for the long-term employees. After an announcement by the managing director, the gifts were presented individually by the heads of the various departments.

**Mr. Victor Breeze**, managing director of Allen West & Co., Ltd., has completed fifty years with the company and sixty years in the electrical industry.

After gaining experience with the British Thomson-Houston Co., Ltd., at Rugby, he joined Allen West & Co., Ltd., shortly after it was incorporated



*Mr. Victor Breeze receiving a presentation from Mr. M. W. H. Lancaster on his completion of fifty years with Allen West & Co., Ltd.*

in 1910. He has been a member of the board since 1920 and has been managing director for the past twenty-seven years. He has taken a leading part also in the development of the company's South African and Rhodesian subsidiaries. His son, **Mr. V. Laurence Breeze, A.R.C.S., B.Sc.**, joined Allen West & Co. in 1940, was appointed to the board in 1950, and has been deputy managing director to his father since 1952.

The company has presented Mr. Victor Breeze with a stereophonic record player. His colleagues on the board paid their personal tribute at luncheon on 8th June when the chairman (**Mr. M. W. H. Lancaster, M.C., F.C.A.**) presented Mr. Breeze with an inscribed silver cigarette casket bearing the company's A.W. monogram and Mrs. Breeze with a compact. From the directors and staff of Allen-



*Mr. S. F. Steward (left) making a presentation to Mr. D. Maxwell Buist on his retirement from B.E.A.M.A.*



west South Africa (Pty.), Ltd., there was an atmospheric clock which was presented to Mr. Breeze by Mr. J. H. Hall, sales director, together with a gold medal commemorating the golden jubilee of the Union of South Africa. On the previous evening Mr. Breeze was entertained to dinner by the foremen of Allen West & Co., whose gift was an inscribed silver salver with facsimile signatures of all the donors. Mr. A. Lucas (general foreman) spoke in appreciation of Mr. Breeze's long and valued career. From the company's apprentices Mr. Breeze received an inscribed table lamp made by the apprentices themselves.

**Mr. E. D. Way** has been appointed electrical manager of J. Samuel White & Co., Ltd., in succession to **Mr. H. G. Cameron**, who has retired after holding this position for thirty-two years.

**Mr. Way** has been assistant electrical manager since 1957 and has also been concerned with the fitting out and trials of many vessels for the Admiralty and foreign governments.

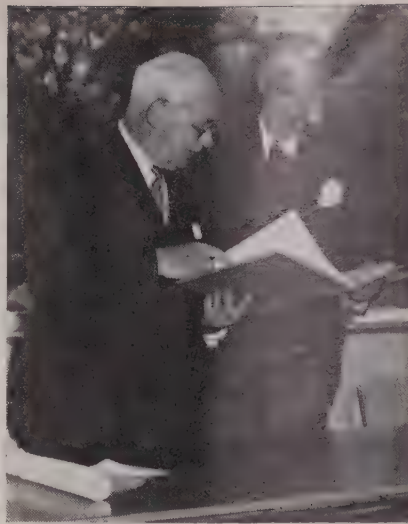
**Mr. C. C. Barnes**, M.I.E.E., M.Amer.I.E.E., A.B.I.M., who writes in this issue on "E.H.V. Power Cables" (page 1149), served with W. T. Glover & Co., Ltd., the St. Helens Cable & Rubber Co., Ltd., Scottish Cables, Ltd., and Standard Telephones & Cables, Ltd., before joining the Central Elec-



Mr. C. C. Barnes

tricity Board in 1947, specialising in all aspects of cable engineering and installation problems. He is now cable engineer on the headquarters staff of the Central Electricity Generating Board. Mr. Barnes is a member of committees of the Electrical Research Association and the British Standards Institution and, as a delegate, has attended meetings of the International Electrotechnical Commission in Philadelphia, Moscow and Copenhagen.

**Mr. A. E. Farmer**, M.Sc., M.I.Mech.E., M.I.E.E., has retired from the position of project engineer, Midlands Project Group, C.E.G.B., after thirty-five years' service in the industry. At a gathering held at the group headquarters tributes to Mr. Farmer's service were paid by Mr. R. R. Maddock (chief project engineer), Mr. F. W. Skelcher (divisional controller, Midlands Division), Mr. G. F. Peirson (deputy chairman, Midlands Electricity Board) and many past



Mr. A. E. Farmer (left) with Mr. R. R. Maddock examining a book containing letters of appreciation from friends and colleagues in the electricity supply industry

and present colleagues. A cheque to purchase a picture was presented to him. Mr. Farmer has spent most of his service on building power stations and has been responsible for and closely associated with major constructional works at Walsall, Ocker Hill, Ironbridge, Wolverhampton, Hams Hall and Rugeley.

The annual general meeting of the **Leicester Electrical Society** was held at the Electricity Sports Club, Aylestone Road, Leicester, on 23rd May, when the following officers were elected for 1960-61:—President, Mr. H. E. Bexter; vice-presidents, Messrs. A. R. Ashton and A. Pope; hon. secretary, Mr. P. J. Mabbutt; and hon. treasurer, Mr. E. E. Warrington.

The Aluminium Development Association announces that **General Sir Geoffrey Bourne**, K.C.B., K.B.E., C.M.G., has been appointed director-general to succeed **Air Commodore W. Helmore**, C.B.E., who recently retired after fourteen years in the position.

At the annual general meeting of the Telecommunication Engineering and Manufacturing Association **Mr. R. A. Moir**, O.B.E., M.C., director, Standard Telephones & Cables, Ltd., was elected chairman of the Association and **Mr. W. F. Oakley**, director, Automatic Telephone & Electric Co., Ltd., was elected vice-chairman.

Some thirty-five members of the **Ipswich and District Electrical Association** were guests of Shell-Mex & B.P., Ltd., on the occasion of the visit to the B.P. Kent Refinery at the Isle of Grain, on 8th June. The chairman of the Association, Mr. R. L. Thurlow, expressed his appreciation on behalf

of the members to the management of the refinery.

**Mr. A. F. McCutcheon**, formerly with Sunbeam Electric, Ltd., has been appointed an area sales manager of Kenwood Manufacturing (Woking), Ltd.

**Mr. E. T. Williams** has joined Crypton Equipment, Ltd., a company in the Metal Industries Group, as sales promotion manager, from David Brown Industries, Ltd., where he was publicity manager.

The annual general meeting of the **Electrical Industries Benevolent Association** will be held on Thursday, 7th July (11 a.m.), at the offices of the Electricity Council, Winsley Street, London, W.1.

## OBITUARY

**Mr. Reginald James Oliver Crawford**, A.M.I.E.E., chief electrical engineer at the Chesterfield works of the Chesterfield Tube Co., Ltd., has died in Sheffield City General Hospital at the age of sixty-five.

## Inadequate Telephone Service

Addressing the delegates to the annual conference, at Eastbourne, of the Post Office Engineering Union on Monday last, the president (Mr. S. C. Rosser) deplored the slow rate of progress of the British telephone service in comparison with other countries' systems. The programme for 70 per cent subscriber trunk dialling by 1966 and a fully-automatic system by 1970 was stretching the meagre resources to the limit and relying to the full on the co-operation of the staff—which had readily been promised. Mr. Rosser also criticised the too-common practice of compelling subscribers to share lines and he also considered that there should be a return to quarterly accounts.

If the Post Office was freed from Treasury control it would be a much better organisation than it is. There had been innovations and changes, giving a better service to the public, during the directorship of Sir Gordon Radley, who because of his engineering background had "breathed life into this vast machine."

## Electrical Fair Deferred

The Electrical Fair, which was to have been held at the Alexandra Palace, London, at the end of September, has been deferred. The organisers say that the majority of exhibitors indicated that they preferred a place in Central London. It is hoped to make a further announcement in the near future.



## INDUSTRY STILL OPTIMISTIC

THE need for further investment in labour-saving equipment is underlined by the situation revealed in the replies to the latest F.B.I. survey of industrial trends. Of the 714 chairmen and managing directors of representative manufacturing companies who replied to the questionnaire towards the end of last month, 40 per cent state that shortage of labour is the factor most likely to limit output during the next four months. More firms than in February report that labour is more difficult to obtain.

The shortage of labour is also the cause of another significant feature of the report that for the first time for a year there has been, on balance, no change reported in the number of hours worked. Nor, in spite of the rising trend of orders and deliveries, has there been more than a slight increase in the number of companies working their plants to full capacity. There is still spare capacity in 40 per cent of the replying companies, and only 16 per cent think that plant capacity will limit their output during the next four months. Other reasons

why output may be limited—each singled out by a sixth of the companies—are lack of orders and shortage of materials or components.

Another important change in the pattern of replies is that for the first time since these inquiries began just over two years ago the majority of firms recording a change in selling prices report that their prices have increased. The main reason for this appears to be the increasing number of firms (47 per cent) whose average costs a unit of output have begun to rise, sometimes sharply. This in turn seems to be almost entirely the result of the increased hourly rates of pay recently awarded in several industries. A larger number of firms report that profit margins have narrowed, though half those replying still report no change.

Though 50 per cent of companies stated that their total output has increased, only 27 per cent report an increase in deliveries for overseas customers. Many firms are obtaining more export orders, but home business is brisker. Once again the business-

men replying to this questionnaire said that they expected to authorise more capital expenditure in the next four months than in the last four. But this tendency towards increased investment is less strong than it was in February.

The broad conclusion of this survey is that further expansion in the economy can be expected over the next few months though at a lesser rate than over the past year. Beyond that much depends upon the ability of management and labour to increase output per man hour, and on whether the recent rise in the import of raw materials for the build-up of stocks, and of some consumer goods, will come to an end or be matched by a parallel rise in exports.

### Sale of S. G. Brown, Ltd.

The Admiralty announced on Monday that, with the approval of the Government, it had decided to sell S. G. Brown, Ltd., precision engineers, of Watford, to de Havilland Holdings, Ltd., "who for this purpose are associated with the American Bosch Arma Corporation." The Admiralty states that de Havilland Holdings, Ltd., a member of the Hawker-Siddeley Group, will retain a controlling interest in S. G. Brown "which will continue to operate as a British company. Special arrangements have been agreed with the new owners to safeguard the continuance of British control." The company's mercantile and naval business will be developed further and at the same time the resources of the new owners "will provide the means for an extension of the company's activities in other fields."

## ENTRY INTO EUROPE

ONLY those people who were very optimistic will have been disappointed at the result of last week's meeting between the "Six" and the "Seven" in the Twenty Nation Trade Committee in Paris. Though the seven E.F.T.A. countries at their recent meeting in Lisbon had shown a more flexible attitude to the problem of future relations between the two trading groups and had gone as far as to express their willingness to regard a customs union as a possible long-term solution, this change of mood had not been reciprocated by the Common Market countries.

As a result the Paris meeting ended only in agreement to discuss, in a new study group, ways in which reciprocal tariff concessions could be achieved. The "Six" consider that such efforts to alleviate short-term trading difficulties should be sufficient to relieve tension between the two groups and to meet the problems of other leading industrial countries such as the United States and Canada. Further efforts to relieve potential difficulties over tariffs will be made at the forthcoming G.A.T.T. talks in Geneva. The official British view is that these short-term arrangements are more palliatives than comprehensive solutions and it is still

considered that only a thorough-going effort to bring the "Six" and the "Seven" together in a European-wide market can be regarded as satisfactory.

### Engineering Industries Urge European Unity

Representatives of the engineering industries of twelve Western European countries, including Britain and France, have decided to urge their Governments to take all possible steps to break down the present impasse between the two economic groups, the "Six" and the "Seven." This was disclosed by representatives of the United Kingdom electrical and mechanical engineering industries on their return to London on Monday from a conference in Sweden of ORGALIME, the organisation of the engineering trade associations in Western Europe. The United Kingdom delegates were: Mr. W. K. G. Allen (chairman, British Electrical and Allied Manufacturers' Association), Mr. A. I. Baker (president, British Engineers' Association), Mr. E. N. Griffiths (vice-president, B.E.A.), Mr. A. W. Berry (director, B.E.A.) and Mr. S. F. Steward (director, B.E.A.M.A.).

### Electrical Industries Club

The value of the British Electrical Power Convention and the important role that it played in furthering the interests of the electrical industry were stressed by Lord Citrine, part-time member, Electricity Council and U.K. Atomic Energy Authority, when speaking at the Electrical Industries Club luncheon meeting in London on Tuesday. He recalled the early days of nationalisation and reminded the 150 or so members and guests present of the intangible assets of the Power Convention, saying that the day that they diminished might well see the decline of the existing good relationships in the electrical industry. A vote of thanks to the speaker was given by Mr. E. G. Batt, vice-president, deputising for Col. B. H. Leeson, president, who was unfortunately again unable to attend owing to indisposition.



## Financial Section

# STOCKS and SHARES

STOCK EXCHANGE markets remain closely concerned with the question of whether or not the Government is going to find it necessary to reinforce the recently imposed credit restrictions, but although this element of uncertainty is limiting the volume of business it has not prevented the industrial sections from displaying a good deal of satisfaction with the rest of the news. Share prices reacted well to another batch of excellent company results and were assisted on an upward course by a much better trend in Wall Street markets. Optimism was also encouraged, on the whole, by the Federation of British Industries' latest survey of industrial trends, although it was tempered by the references to labour shortages and to the effects of wage increases and a shorter working week upon the level of production costs.

### Firm Markets

Gains of a shilling or so appeared plentifully in the electrical price lists during the first fortnight of this month, although shares of the major groups behaved rather disappointingly, A.E.I., English Electric and G.E.C. all losing a part of previous advances. Reyrolle at 42s and C. A. Parsons at 54s 9d continued upwards to the extent of a further 1s 9d each in response to recent comment on the links now established between these companies and A.E.I. S. Smith were also 1s 9d to the good at 18s 6d and Lucas at 67s 6d were 2s up, interest being aroused by news of the company's progress into the field of electronic navigational equipment.

### Higher Prices

Ever Ready rose a further 2s, to 27s 6d, still under the influence of the excellent annual results, and Decca "A" at 46s 3d continued to benefit from the declaration of the increase in the interim payment. Among domestic equipment issues, Hoover were relatively subdued but there were useful improvements in Berry's Electric at 35s 6d and Morphy-Richards at 23s 6d. A rise of 5s 6d to 53s 9d in Thorn Electrical took the shares into the category distinguished by a yield of less than 2 per cent, while the return

from I.C.T. fell below the 3 per cent mark as a result of a 2s 6d rise to 70s. Among other low yielders, Philips' Lamps took another spectacular leap to £10½. Walsall Conduits were quoted at 14s 3d after the announcement of slightly higher trading profits and an

improvement in the dividend to 15 per cent.

### Elliott-Automation Progress

Supporters of the 5s shares of Elliott-Automation were evidently strengthened in their convictions about

## Price Changes in

Company or Board	Nom. Value	Middle price 13th June	Two Weeks' Rise or Fall	Dividend		Yield %	1960		
				Pre-vious	Last		High-est	Low-est	
Gilt-edged Stocks							£	s	d
Brit. Elec. 1968/73	100	76	—½	3	3	3 19 0	79½	75½	
Brit. Elec. 1974/77	100	72	—1	3	3	4 3 3	76	72	
Brit. Elec. 1976/79	100	75	—½	3½	3½	4 13 3	79½	75	
Brit. Elec. 1974/79	100	85½		4½	4½	4 19 6	90½	85½	
Brit. Elec. 1967/69	100	92½	—1	4½	4½	4 17 3	97½	92½	
Overseas Electric Supply									
Calcutta Elec.	£1	21/-	+6d	6-8†	7†	10 17 3	20/9	19/3	
East African Power	£1	16/6	+6d	7½	8	9 14 0	20/3	16/-	
Nigerian Elec.	£1	16/6	+1/-	8	8	9 14 0	19/9	15/6	
Perak Hydro-Elec.	£1	19/-	+1/6	10	5	5 5 3	19/-	15/3	
Electrical Shares									
Aberdare Holdings	5/-	15/6	—3d	17½	17½	5 6 0	19/-	15/3	
Aerialite	1/-	8/9	+9d	54	54	6 3 6	9/6	7/6	
Allen, W. H.	£1	56/-	+2/3	12	14	5 0 0	60/-	51/3	
Allied Insulators	5/-	20/-		—	20	5 0 0	23/3	20/-	
Anglo-Portuguese Tel.	£1	28/3	—9d	9	9	6 7 6	29/-	26/-	
Arcoelectric	1/-	4/3		—	15	3 10 6	5/6	4/-	
Aron Elec. Ord.	£1	75/-	+5/-	15	15	4 0 0	75/-	47/-	
Assoc. Elec. Ord.	£1	58/3	—1/-	15	15	5 3 0	66/6	50/6	
Automatic Tel. & El.	5/-	17/9	+6d	17	17	4 15 9	21/9	17/3	
Babcock & Wilcox	£1	38/9	+6d	13	9	4 13 0	48/9	33/6	
Bakelite	10/-	56/3	+3/9	15	17½	3 2 3	56/3	40/-	
Baldwin, H. J.	2/-	2/-		20	—		2/6	2/3	
Berry's Electric	5/-	35/6	+1/-	10	20½*	2 16 3	38/-	29/6	
Bowthorpe Holdings	2/-	8/6	—3d	27	18½*	4 7 0	11/6	8/-	
British Elec. Traction:									
Def. Ord. "A"	5/-	49/-	+2/-	25	35	3 11 6	49/3	42/-	
B.I. Callender's	£1	52/3	+3d	13½	13½	5 3 6	61/-	50/-	
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	21/-	19/9	
British Thermostat	5/-	23/9	+1/-	35	20*	4 4 3	26/-	21/3	
Brook Motors	10/-	46/3		25	25*	4 12 9*	53/6	45/6	
Bulgin, A. F.	1/-	9/6		50	55	3 17 0*	10/3	8/-	
Bulpitts	5/-	17/6		15	16½	4 12 9	23/3	17/-	
Burco Dean	5/-	12/6	—3d	16	18		15/9	12/6	
Cable & Wireless	5/-	16/9	+3d	10	10*†	2 19 9	18/3	14/3	
Chloride El. Storage "A"	£1	72/6		20	17½*	4 16 6	74/-	65/6	
Clarke Chapman	£1	48/9		13½	13½	5 12 9	63/6	48/9	
Cole, E. K....	5/-	23/-	—3d	17½	20	4 7 0	31/9	22/-	
Contactar Switchgear	5/-	16/6		14	14	4 4 9	17/9	15/9	
Cossor, A. C.	5/-	7/-	—3d	Nil	5	3 11 6	10/-	7/-	
Crabtree	10/-	24/-		20	22½†	4 13 9*	28/3	24/-	
Crompton Parkinson	5/-	13/6x.d.		12	14	4 3 0*	15/-	11/9	
Davis & Timmins	5/-	23/-x.c.	+2/-	20	25	4 7 0*	23/-	17/-	
De La Rue	10/-	77/-	+7/-	20	22½	2 18 6	75/-	62/-	
Decca "A"	10/-	46/3	+6d	50	20*	4 6 6	51/3	42/-	
Desoutter	5/-	43/-	+1/-	21½	30	3 9 9	42/-	37/6	
Dewhurst	2/-	7/6		20	20	5 6 9	8/6	7/6	
Dictograph Tel.	2/-	9/3	—3d	20	20	4 6 6	9/9	9/-	
Dimplex	5/-	32/-	+2/-	—	25†	3 18 3	32/6	26/9	
Dubilier Condenser	1/-	5/6		20	25	4 11 0	6/-	5/-	
Duport	5/-	25/6	—6d	12½	17½	3 8 9	30/3	22/-	
E.M.I.	10/-	51/-	+1/-	20	14½†	2 14 9	58/9	45/-	
Electrical Apparatus	5/-	16/-	+1/-	14½	14½	4 11 0	16/-	12/9	
Electrical Components	5/-	9/9	+3d	12½	15	5 2 6*	13/9	9/6	
Elec. Construction	£1	37/6		8½	9	4 16 0	43/-	35/3	
Elliott-Automation	5/-	26/-	+1/-	—	9-3*	1 15 9	26/-	19/9	
Enfield Rolling Mills	£1	53/6	+1/-	15	15	5 12 3	56/3	48/-	
English Electric	£1	41/3	—6d	14	10*	4 17 0	53/-	38/9	
English Electric 3½% Pref.	£1	12/-	—6d	3½	3½	6 5 0	13/-	12/-	
Ericsson Tel.	5/-	22/6		13†	13†	4 14 3	28/6	22/6	
Ever Ready	5/-	27/6	+2/-	27½	20*	3 12 9	27/6	23/-	
Falk Stadelmann	£1	32/-		10	10	6 5 0	35/9	32/-	

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

\* After scrip issue.

† Free of income tax.

‡ Dividend indicated.

the future of the investment as a result of Mr. R. de Trafford's review of affairs in the annual report, for the price of the shares was subsequently advanced further to 26s (the highest yet recorded) and the yield on the current rate of dividend contracted to

no more than  $1\frac{3}{4}$  per cent. Last year's 25 per cent rise in group profits, which crossed the million mark for the first time, are attributed by the chairman to a substantial rise in turnover allied to improved efficiency. Regarding prospects in the present year the

chairman reports a considerable growth in the order book, and with deliveries running well ahead of last year's he tells the company's 10,000 shareholders that, with the usual reservations, they can expect 1960 to be another year of real progress.

## Electrical Investments

Company or Board	Nom. Value	Middle price 13th June	Two Weeks' Rise or Fall	Dividend		Yield %	1960	
				Pre- vious	Last		High- est	Low- est
Electrical Shares—continued						£ s d		
G.E.C. ...	£1	39/9	— 1/3	10	10	5 0 9	47/6	37/-
G.E.C. 6½% Pref. ...	£1	20/6	— 6d	6½	6½	6 6 9	22/3	20/6
General Cables ...	5/-	5/9		15	Nil	—	10/-	5/9
Goblin (B.V.C.) ...	5/-	9/3	— 3d	7½	12½	6 15 3	13/9	9/3
Hackbridge Holdings ...	5/-	15/9		20	20	6 7 0	17/3	15/-
Hackbridge & Hewittic ...	5/-	14/9	+ 6d	20	20	5 1 9*	15/-	13/-
Head Wrightson ...	5/-	22/6		20	14*	3 2 3	31/6	21/3
Heatrae ...	2/-	12/-		20	22½	3 15 0	12/3	8/9
Holophane ...	5/-	18/-		22½	26	7 4 6	20/6	17/6
Hoover ...	5/-	49/6	— 6d	60	90	4 11 0*	55/-	45/-
Intl. Combustion ...	5/-	28/9		30	30	5 4 3	46/9	26/6
Intl. Computers & T. ...	£1	70/-	+ 2/6	—	10	2 17 3	78/6	61/6
Johnson & Phillips ...	£1	21/6x.d.	+ 1/6	5	Nil	—	24/-	19/6
Laurence Scott ...	5/-	20/-		15	15*	3 15 0	25/3	18/-
Lister, R. A. ...	£1	54/-	+ 1/6	12½	14	5 3 9	62/-	52/6
Lucas, J. ...	£1	67/6	+ 2/-	10	12½	3 14 0	74/6	65/-
Marryat & Scott ...	2/-	15/-		37½	22½*	2 19 0	16/9	14/3
Mather & Platt ...	£1	47/6	— 1/3	10½	11	4 12 6	59/-	47/6
Metal Industries ...	£1	64/-x.r.	+ 6d	14	15½	4 13 9	76/3	61/3
Midland Elec. Mfg. ...	£1	58/9		10	12	4 2 0	58/9	53/6
Morphy-Richards ...	4/-	23/6	+ 2/-	20	25	2 2 6	23/6	16/3
Murex ...	£1	70/-	+ 1/3	17½	15	4 5 9	77/-	62/6
Newman Ind. ...	2/-	5/3		10	12½	4 15 3	5/3	4/-
Oldham & Son ...	1/-	3/3		17½	17½	5 7 9	3/3	2/9
Parsons, C. A. ...	£1	54/9	+ 1/9	8½	9½	3 8 6	59/-	46/-
Philips' Lamps ...	Fl.10	215/-	+ 16/3	13/3	16	1 9 9	£10½	137/-
Plessey ...	10/-	49/-x.d.		20	14**	2 17 3	54/6	44/3
Pye ...	5/-	17/3	+ 6d	12½	12½**	3 12 6	19/-	16/-
Pyrotex ...	5/-	56/-		—	34	3 0 9	56/-	44/3
Radiation ...	£1	37/6	— 1/-	6	12	6 7 9	44/6	34/6
Reliance Clifton ...	5/-	23/-		15	15	3 5 3	28/-	22/-
Reyrolle ...	£1	42/-	+ 1/9	17½	17½	4 3 3*	52/3	38/-
Rheostatic ...	4/-	15/3		20	18½**	4 18 3	16/6	12/6
Richardsons Westgarth ...	10/-	10/3	— 6d	8½	8½	8 2 0	14/9	10/3
Sangamo Weston ...	10/-	21/-	+ 1/-	12½	11*	5 4 9	22/9	19/3
Simon-Carves ...	5/-	47/6	— 1/-	25	35	—	54/-	36/-
Smith (England), S. ...	4/-	18/6	+ 1/9	12½	17½	3 15 9	20/-	16/-
Southern Areas ...	£1	14/6		Nil	5	6 18 0	15/6	13/-
Strand Elec. ...	5/-	16/3	+ 6d	15	20	6 3 0	20/3	15/9
Sturtevant ...	5/-	15/9	+ 9d	15½	15½	7 16 0	24/3	15/-
Sun Elec. ...	5/-	15/9		25	15*	4 15 3	16/3	15/-
Switchgear & Cowans ...	5/-	16/-		15	17½	5 9 6	18/9	16/-
T.C.C. ...	10/-	46/3		25	35	5 1 0*	48/3	37/3
Telephone Mfg. ...	5/-	6/6	+ 1/-	10	5	3 17 0	7/3	5/-
Telephone Rentals ...	5/-	20/9	+ 6d	12½	15*	3 12 3	20/9	17/-
Thompson (John) ...	5/-	18/3		25	20	5 9 6	25/9	17/3
Thorn Elec. ...	5/-	53/9	+ 5/6	17½	20	1 17 3	55/6	44/3
Thornycroft ...	£1	25/-		7½	6	4 16 0	31/-	23/-
Tube Investments...	£1	82/6	+ 3/9	20	13½	3 3 0	95/6	65/3
Vactric ...	5/-	30/9	— 3/-	25	37½	6 2 0	43/9	30/9
Walsall Conduits ...	4/-	14/3	+ 6d	22½	15*	4 4 3	16/-	13/9
Ward & Goldstone ...	5/-	59/6	+ 1/-	25	30	2 10 6	60/-	51/3
Watford ...	2/-	11/-	— 6d	25	25	4 11 0	17/6	11/-
Westinghouse ...	£1	50/-		10	11	4 8 0	59/9	49/-
West, Allen ...	5/-	13/-		12½	12½*	4 16 3	17/-	12/6
Wilkins & Mitchell ...	5/-	21/-	+ 1/-	15	17*	4 1 0	25/9	19/9
Wolf Electric ...	5/-	13/-	+ 3d	10	12½	4 16 3	13/3	10/9

## J. & P. Prospects

Despite a record volume of sales, the collapse of the cable price structure resulted in a trading loss of £91,000 for Johnson & Phillips last year. On the preliminary announcement of this result the £1 shares had been marked down below 20s but they recovered to 21s 6d on the appearance of the full report. In his review Mr. W. Glass indicates better things in the present year. Demand for the products since the middle of last year is described as buoyant and orders have been coming in at a higher rate. Because the improvements in cable prices were not effective for the first quarter of this year the company made a loss in that period, but the board foresees a profit for the year as a whole, and believes that the cable industry is over the worst of its troubles. No dividend is being paid on account of 1959 but shareholders receive a 3 per cent tax-free payment from capital profits of £245,000 net arising from the realisation of investments.

## Reliance-Clifton

Adverse trading conditions affected last year's earnings of Reliance-Clifton Cables & Industrial Products, but with the aid of larger investment income the contraction in the net surplus after tax was limited to 16 per cent, at £206,000. There remains a more than ample margin for the maintenance of the dividend at the previous total of 15 per cent. The earnings cover for the distribution is still more than fourfold and it is again being supplemented by a distribution from capital profits. The latter produced £213,000 and after providing for the extra payment of 5 per cent (which is  $1\frac{3}{4}$  per cent more than last year's) this account still stands at £193,000.

## De La Rue

Expectations of good results from De La Rue were more than satisfied by the company's announcement of an improvement of practically 50 per cent in net profits; an increase in the dividend from 20 to  $22\frac{1}{2}$  per cent; a 25 per cent scrip issue; and the intention to maintain the same rate of dividend on capital so increased. The shares were marked up by 7s, to 77s, at which level the yield will be a little under  $3\frac{3}{4}$  per cent if the dividend intentions materialise.



## REPORTS and DIVIDENDS

**Johnson & Phillips, Ltd.**—The report and accounts for 1959 now issued confirm the preliminary figures given in our last issue.

In his accompanying statement, Mr. W. Glass (chairman and managing director) says that the sales of the group for 1959 amounted to approximately £9 million, which is a record volume for the company, but the collapse of the cable price structure is the basic reason for the bad results. The position is ameliorated to a small extent by the profit on realisation of investments, which amounted to a net gain of £244,657 and has enabled the board to recommend a distribution to ordinary shareholders at the rate of 3 per cent (not subject to tax) out of capital profits.

Dealing with the abandonment of the traditional pricing arrangements by the principal manufacturers in the cable industry, Mr. Glass says that a price war of extreme violence developed, especially in rubber and thermoplastic cables and low voltage mains cables. By the end of the year prices in many cases no more than covered the cost of labour and materials. The price war has cost the industry a revenue probably of the order of £5 million. Since the end of the year prices have hardened somewhat but in certain sections, especially in rubber and thermoplastic cables, there is still a long way to go before a reasonable profit will be available. Coincident with the abandonment of price fixing arrangements, demand tended to build up and the value of the company's order intake at current prices in the second half of 1959 exceeded the first half by no less than 40 per cent and at the end of April last the orders in hand were double the level at which they entered 1959 in spite of much lower prices now ruling. There has also been keen competition in the transformer business. The full force of the competitive influences can best be brought home by stating that the company's sales of cables and transformers for 1959, if valued at the prices ruling at the beginning of that year, would have provided an additional revenue of no less than £465,000.

Referring to the establishment of local manufacturing in important markets overseas, Mr. Glass says that the continuing expansion of such manufacture has tended to reduce exports from the home factories to these markets, but in spite of this, direct exports of both finished goods and components for overseas factories show an increase over the previous year.

Their factories in Australia, South Africa, Pakistan and an associated factory in India, are developing rapidly and expansion projects are in hand in the last three of these territories. Additionally, an entirely new investment in India is being negotiated. The capital required for the extensions to the manufacturing facilities mentioned will be found from within the company's resources. Reference was made last year to difficult trading conditions in Canada and they are now withdrawing their direct representation in that country. Export prices for goods manufactured at home are very keen and competition, especially from European manufacturers with more stable domestic markets, is severe. The company is paying due attention to development of its business with Western Europe and a substantial and increasing volume of business has been secured from that area.

The demand for their products has been buoyant since mid-way through 1959 and the order intake in the current year continues at a high level. There is a small improvement in cable prices and it is possible that further much-needed increases will materialise. Evidence of the effect of any such increases will, however, be slow to appear in the profits because the pattern of the cable trade is such that substantial blocks of output are sold against period contracts. The board holds the view that the most severe part of the storm in the cable industry is over, but the increased cable prices were not effective for the first three months of 1960 and as a consequence there is a loss for that period. Their budget for the year, however, forecasts a profit.

**De La Rue, Ltd.**, reports a group turnover for the year to 2nd April last of £17 million, as compared with £13.8 million for 1958-59, and a group trading profit of £2,148,211 (against £1,500,577). Taxation absorbs £1,141,387, and the net balance is £1,140,995 (against £764,665), of which £730,862 is attributable to the parent company. It is proposed to pay a final dividend of 1s 9d per 10s share, making 2s 3d per share for the year (against 2s per share) on increased capital. It is also proposed to make a one-for-four scrip issue.

**Ever Ready Co. (Great Britain), Ltd.**—The annual meeting will be held on 6th July. In his review of the year, which has been circulated to stockholders, Mr. E. N. Rowbotham (chairman) says that earnings for the year

to 27th February last increased and constitute yet another record in the history of the company. During the year under review they have expended £225,000 on extensions to buildings, including the purchase of the freehold of the main office buildings at Hercules Place, and £470,000 on the modernisation of plant and machinery, and further substantial expenditure under these heads is envisaged in the coming year. The directors decided to make reductions in the retail prices of a number of radio batteries in the home market as from March last. The sales of Berc International, Ltd., were substantially greater than last year's record.

Dealing with trade in Europe, the chairman says that for many years they have had an investment in two companies in Germany manufacturing dry batteries and towards the end of the year agreements were reached whereby they acquired substantial interests in other countries on the Continent of Europe.

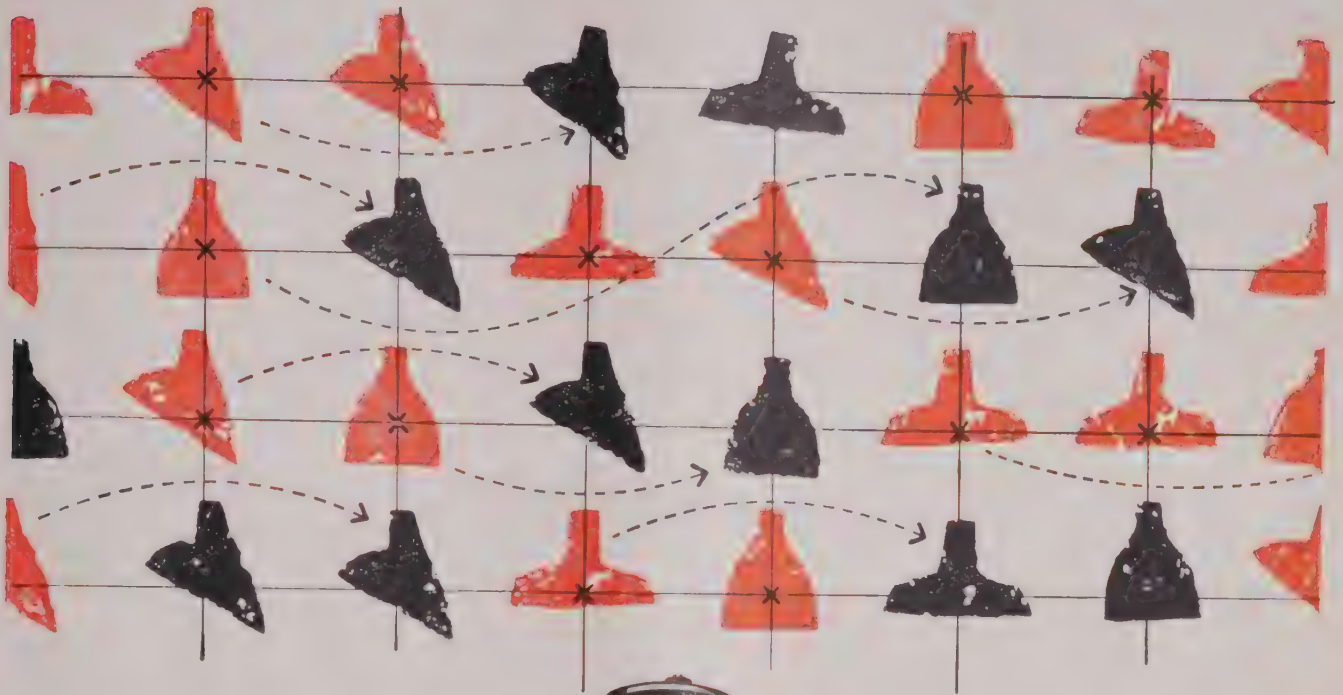
The number of dry battery powered radio sets produced by all the leading manufacturers now exceeds the number of mains operated and car radio types. In 1954 25 per cent of the radio sets sold in this country were dry battery operated, but in 1959 this proportion had risen to over 50 per cent and is still increasing. They anticipate a substantial increase in sales during the coming year for the range of "Power Pack" batteries for radio sets and other transistorised equipments, which was introduced three years ago. The current year's trading to date is encouraging and Mr. Rowbotham says that sales at home and overseas are in excess of last year's.

**Walsall Conduits, Ltd.**—The group profit for 1959 amounted to £666,047, as compared with £662,461 for 1958, and after providing £307,340 for taxation, the net balance is £358,707 (against £340,711). General reserve receives £40,000 and it is proposed to pay a final dividend of 10 per cent, making 15 per cent for the year (against an equivalent of 12.85 per cent after allowing for a scrip issue). The balance carried forward is £798,682 (against £1,128,491), after £600,000 capitalisation.

**W. H. Allen, Sons & Co., Ltd.**, report a trading profit for 1959 of £903,630, as compared with £1,038,769 for 1958, and after deducting taxation of £412,000, the net balance is £491,630 (against £513,769). It is proposed to pay a final dividend of 11½ per cent (against 9½ per cent, which included a special interim dividend of 3 per cent),

[Continued on page 1183]

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**FINANCIAL SECTION** (Continued)

making 14 per cent (against 12 per cent) for the year. The practice of carrying forward a balance on profit and loss account has been discontinued, and after allocating £67,758 to reserve for increased cost of replacement of fixed assets, the balance of £300,962 is placed to general reserve. It is proposed to make a one-for-two scrip issue.

**Aron Electricity Meter, Ltd.**, reports a trading profit for the year to 31st March last of £44,614, as compared with a loss of £14,298 for the preceding year. Taxation absorbs £15,888, and the net profit is £28,726 (against a loss of £17,194). The dividend for the year is maintained at 15 per cent and £49,907 is carried forward (against £35,140 brought in).

**Elliott-Automation, Ltd.**—The main figures in the accounts for 1959 were given in our issue of 6th May. With the full report and accounts now issued, Mr. R. E. F. de Trafford (chairman) reviews the activities of the group during the past year.

In this he says that the profit of the group, before taxation, exceeded £1,000,000 for the first time, and represented an increase of 25 per cent over 1958. This improvement is attributable in the main to a substantial rise in turnover and to improved efficiency. Although capital commitments, as shown in the accounts, were low at the turn of the year, the policy of installing the latest type of equipment is continuing and they envisage the investment of substantial further sums on plant and buildings in the current year. Moreover, research and development continued and will continue on a heavy scale. Since the turn of the year they have acquired for cash the nucleonic instrument business of Isotope Developments, Ltd., and they have also acquired the business of Black Automatic Controls, Ltd. A trade agreement has been negotiated with a French engineering company, Manufacture de Machines du Haut-Rhin, which will involve an investment on their part of approximately £250,000 in that company, which proposes under their auspices to build up an automation business fashioned on their own pattern and should give them a valuable position within the Common Market. They believe that a substantial income from sales and royalties will accrue in due course from the French company, on whose board they are to be represented.

The group comprises some fifty divisions, each concerned with a particular sector of automation. Its con-

tinued expansion and development has required on an average the addition of some five or six divisions in each of the last years. The National Cash Register Co., Ltd., who market their computers for business applications, have recently started selling the new Elliott transistorised machine—the 803—while they have been invited by that company to manufacture in this country an advanced N.C.R. American-designed computer.

Business abroad and in the export field is showing substantial expansion and is making a valuable contribution to turnover. Elliott-Automation A.G., formed some two years ago in Switzerland, secured in 1959 its first large contract involving the complete instrumentation of an oil refinery. It is envisaged that some of the companies they have formed in Australia, Germany and the Netherlands will have facilities for at least partial local manufacture. They have recently formed a new company—E-A Automation Systems, Ltd., which will advise the various process industries on integrated automation systems.

Regarding the current year, the order book has grown considerably and deliveries this year are running well ahead of last year.

The company has issued a booklet, "The A.B.C. of 'Electronic Brains'," which is a reprint of six talks broadcast in the external service of the B.B.C. by Mr. L. Bagrit, deputy chairman and managing director.

**Engineering & Lighting Equipment Co., Ltd.**—The profit for the year to 31st March last, after providing for taxation, is £70,859, as compared with £58,904 for the preceding year. The dividend for the year is maintained at 20 per cent by a final payment of 15 per cent.

**Marco Refrigerators, Ltd.**, has declared an interim dividend of 2½ per cent (unchanged).

**New Companies**

**S. W. Parks (Lewes), Ltd.**—Registered 28th March. Capital £1,000. Electrical engineers, etc. Directors: S. W. Parks and A. T. Deacon. Regd. office: 13, Prince Albert Street, Brighton, 1.

**Landmar Electrical Engineering, Ltd.**—Registered 30th March. Capital £1,000. Electrical, electronic and mechanical engineers and contractors, etc. Directors: G. B. M. Hayes, G. F. R. Hayes, M. R. L. Hayes and F. E. S. Hayes. Regd. office: The New Foundry, Bridgend, Glam.

**Television & Electrical Services, Ltd.**—Registered 30th March. Capital £100. Manufacturers of and dealers in electrical goods, etc. Directors: Mrs. Evelyn P. Hoath and P. S. Goldsmith. Regd. office: 46, Brighton Road, Salfords, Redhill.

**Hughes Electrical, Ltd.**—Registered 10th May. Capital £100. Electrical contractors, etc. Directors: D. W. Hughes and C. Hughes. Regd. office: 8, St. Johns Road, Woking.

**A. B. Slade & Co., Ltd.**—Registered 30th March. Capital £1,000. To acquire the

business of an electrical contractor carried on by A. B. Slade at Jordans, Bucks., etc. Directors: A. B. Slade, Annie Slade and D. L. Pelton. Solicitor: B. Gibson, Beaconsfield.

**Norrland Laboratories, Ltd.**—Registered 30th March. Capital £100. Manufacturers of and dealers in dynamos, motors, armatures, etc. Solicitors: Buckeridge & Brawnne, 3/4, Clement's Inn, W.C.2.

**Increases of Capital**

**Twickenham Transformers, Ltd.**—The nominal capital has been increased to £30,000 and now consists of £20,000 in £1 ordinary shares and £10,000 in debentures. The issued capital is £9,525 in ordinary shares and £10,000 in debentures.

**Elliott-Automation, Ltd.**—Increased by £1,500,000, in 5s ordinary shares, beyond the registered capital of £6,500,000.

**Semiconductors, Ltd.**—Increased by £400,000, in 196,000 "A" ordinary and 204,000 "B" ordinary shares of £1 each, beyond the registered capital of £500,000.

**Bankruptcies**

**A. J. D. Copper and R. W. Hutchings**, carrying on business together under the style of Roydon Domestix at 24, Lewisham Road, Lewisham, London, S.E.13, electrical domestic retailers.—Receiving order made 31st May on debtors' own petition.

**R. W. Scott**, lately carrying on business at 44, Market Parade, Rye Lane, Peckham, London, S.E.15, as Bromly Ignition Co., electrician.—Order made 5th May granting discharge subject to consenting to judgment being entered against him for the sum of £100 and £1 10s costs.

**C. W. G. Gunther, F. G. M. Gunther and P. G. Bowen**, all of 21, Chiswick Lane, London, W.4, and formerly residing at 1, Bolton Road, Chiswick, W.4, and trading as Grove Electrical Appliances and also as Grove Electrics at 758, Fulham Road, London, S.W.6, electrical retailers.—Trustee, Mr. R. A. Hawken, Bank Chambers, 1, John Street, London, W.C.1, appointed 26th May.

**D. Cornish**, 6 and 8, Maperton Road, Bradford, trading as Cornish & Graham as an electrical engineer and contractor and a hardware retailer.—Trustee, Mr. G. E. Rushton, 36, North Parade, Bradford, appointed 31st May.

**A. Banoff** (trading as Almy Radio Electric Co.), lately carrying on business at 111, Church Road, Hove, electrical and radio engineer.—Last day for receiving proofs for dividend 18th June. Trustee, Mr. T. H. Parker, 8, Old Steine, Brighton, 1, Official Receiver.

**F. Jones and B. P. Callaghan**, formerly trading in co-partnership at 2, Farm Yard, Levenshulme, Manchester, under the style of Jones & Callaghan, electrical engineers and sheet metal workers. (Separate estate of B. P. Callaghan).—Last day for receiving proofs for dividend today (Friday). Trustee, Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3, Official Receiver.

**G. Dickinson and K. G. Dickinson**, carrying on business in partnership under the style of G. & K. G. Dickinson at 134, Clispley Lane and 321, Church Road, Haydock, Lancs., electricians.—Second and final dividend of 5s in the £, payable on and after 30th June at 5, Rumbold Place, Liverpool, 3.

**Liquidations**

**Estreich Electrical Co., Ltd.**, radio and television and electrical dealers, 98, Commercial Road, London, E.1.—Winding up voluntarily. Liquidators, Mr. S. Primost, 65, London Wall, E.C.2, and Mr. A. W. Hunter, 418-22, Strand, London, W.C.2, appointed 17th May.

**Rye Electrics, Ltd.**, radio, television and electrical retailers and engineers, 27, Falconwood Parade, The Green, Welling, Kent.—Winding up voluntarily. Liquidator, Mr. R. A. Hawken, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, appointed 24th May.



## NEW ELECTRICAL EQUIPMENT

### Infra-red Heater

The element spiral in the "Becosil" model 303 industrial infra-red heater announced by GATEHILL BECO, LTD., Kennard Street, Stratford, E.15, is made of 80:20 nickel-chromium and is contained in a solid drawn metal tube which is continuously supported down its entire length. The spiral is embedded in magnesium oxide which provides the insulation between the live element and the outer metallic sheath. The element exterior is of stainless steel and sealed against moisture ingress. It is equipped with a nylon on-off switch control cord, ceiling hooks and suspension chains. Operation is possible from either a horizontal or vertical position. Model 303 heaters are available in loadings of 1 kW (price £5 5s); 1½ kW (£9); and 3 kW (£10 19s).

### Process Timer

The type IMP process timer announced by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20, is self-resetting, can be started by a remote switch and can provide a variety of switching arrangements. Models are available covering full-scale times from 30 sec with ½ sec settings up to 24 hr with 20 min settings.

The timer is driven by a self-starting synchronous motor which runs continuously, timing taking place only when an electromagnetic clutch is

can be supplied to accept other a.c. voltages and the four change-over contacts incorporated are each rated at 2 A, 250 V a.c. Both flush and wall mounting types are available, priced at £12 17s 6d and £13 17s 6d respectively.

### Washing Machine/Spin Dryer

The "Gay-Day" combination washing machine and spin dryer now being marketed by ZETA DOMESTICS, LTD., Brighouse, Yorkshire, has a "Stelvetite" plastic-coated sheet steel cabinet produced by John Summers & Sons, Ltd. The finish is in white with a blue and grey plastic trim with gold embellishments. Rubber castors are fitted and there is a totally enclosed box mounted on the back panel, which houses the coiled flexible and plug.

The machine has a capacity of 6 lb dry weight of clothes and incorporates a 3 kW immersion heater and a pump. The agitator is a polished aluminium casting. The spinner drum is also of aluminium and the whole spinner unit is rubber cushioned. It is driven by a 100 W motor and operates only when the lid is closed. Both the washing machine and spin dryer pumps have a common outlet in a swivelling arm, which can be raised or lowered to empty the water into the sink or back into the wash tub. The controls are mounted at the top of the cabinet and all switches are of the double pole type and situated on the chassis where they are readily accessible for servicing.

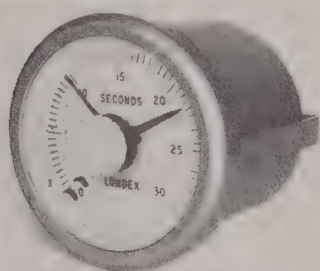


Zeta Domestics "Gay-Day" washing machine spin dryer

The appliance measures 31½ in high by 32½ in wide by 18½ in deep. The price, including purchase tax, is 79 gns and a table top is available, as an optional extra, at £2 19s.

### Oil Circuit-Breaker

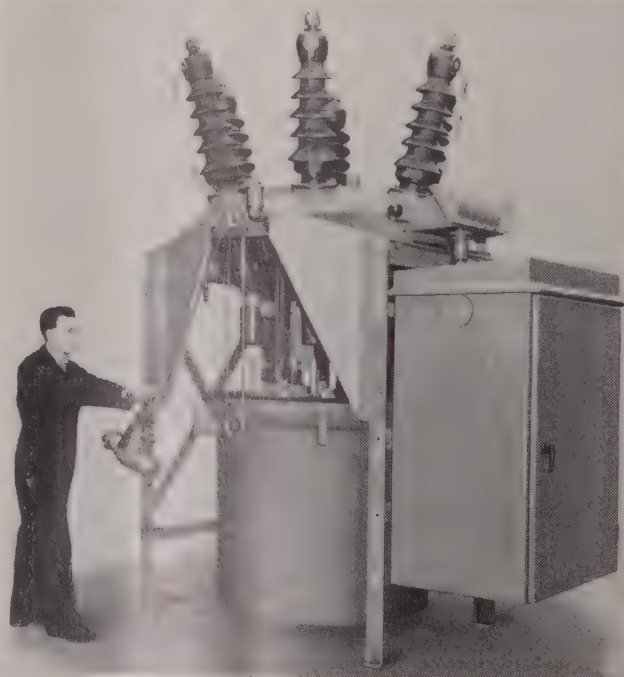
A 33 kV single tank outdoor oil circuit-breaker has been added to the range produced by the ENGLISH ELECTRIC CO., LTD., Marconi House, Strand, London, W.C.2. Named the OKM5, it has a current rating of 2,000 A and a breaking capacity of 1,000 MVA, or alternatively 1,500 MVA. It is suitable for controlling the 33 kV side of 90 MVA and 100



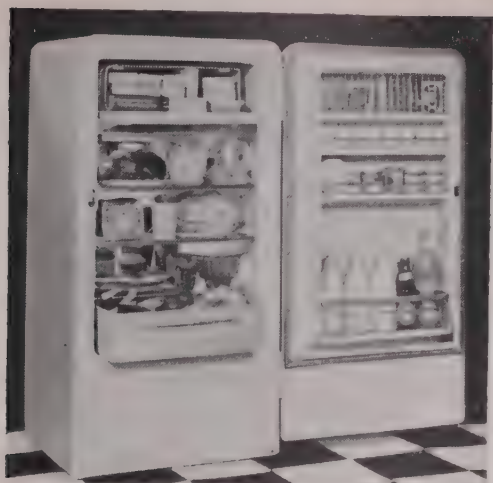
Londex process timer

energised. This operates two change-over contacts instantly and couples a timing pointer to the motor via a dog tooth clutch. When this pointer reaches zero, a changeover contact operates, followed after a short interval by a second contact. A 15-pin fixed plug is incorporated and the timer is supplied with a corresponding free socket to which the user makes connections by a multi-core cable.

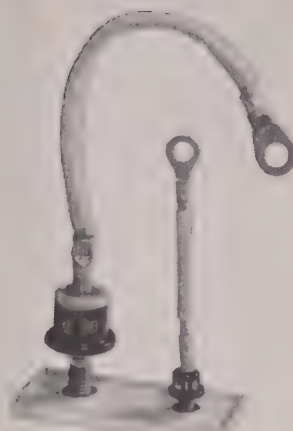
The units operate from a 200/250 V, 50 c/s supply, although transformers



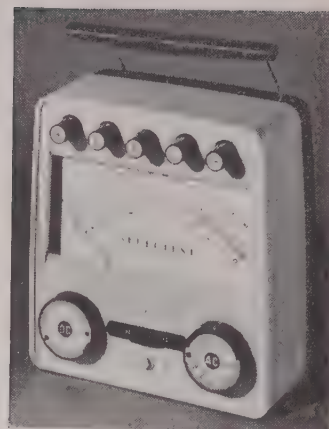
English Electric 2,000 A oil circuit-breaker



Allied Ironfounders "Leisure"  $5\frac{1}{2}$  cu ft refrigerator



J. Stone & Co. series G50 (left) and G10 germanium rectifiers



Salford Electrical Instruments "Super K" multi-range test set

MVA grid transformers. A full A.S.T.A. Certificate series of short circuit tests have been carried out for 1,000 MVA and 1,500 MVA at 33 kV, and 1,000 MVA at 22 kV. A 46 kV pattern is also available. Based on the design of the OKM4 type, the new breaker has the same facilities for maintenance and the same methods of closing: solenoid, pneumatic, and hand- or motor-wound spring.

### Domestic Refrigerator

With the introduction of the "Leisure"  $5\frac{1}{2}$  cu ft refrigerator, ALLIED IRONFOUNDERS, LTD., 28, Brook Street, London, W.1, is the latest company to enter the refrigeration market. The new model is a compressor type, operated by a "Tecumseh" condensing unit, and it has a usable shelf area of approximately 11 sq ft. It has a full-width freezer compartment, with accommodation for up to twenty packets of frozen food, and a salad crisper. Extra storage space is provided in the door interior and other features include a large chill tray, automatic interior light and a door lock. The refrigerator interior is in two-tone colours, with gold trim, and the exterior is finished in white enamel. The refrigerator is fully guaranteed for one year and the sealed unit for five years. The price, including purchase tax, is £78 15s.

### Semiconductor Rectifiers

The development of a range of germanium power rectifiers comprising the G10 and G50 series has now been completed by J. STONE & CO. (DEPTFORD), LTD., Gatwick Road, Crawley, Sussex.

Cells in the G10 series are rated for a mean direct current of 10 A and peak inverse voltages of 50, 100, 150 and 200 V. The mean voltage drop per cell is 0.55 V and the saturation current is 3 mA maximum. The peak reverse

current at rated p.i.v. varies from 8 to 6 mA and the forward dissipation with three-phase full-wave rectification is 6 W, the reverse dissipation being 0.27, 0.47, 0.71 and 0.8 W respectively. These values refer to cells operating at a maximum base temperature of 60°C and passing full load forward currents. The standard aluminium cooling fins are 6in square by  $\frac{1}{16}$ in thick and are suitable for natural convection cooling under ambient temperatures up to 35°C.

The G50 series cells are rated at 55, 50, 45 and 45 A at a rated p.i.v. of 50, 100, 150 and 200 V respectively. These cells have a single cycle surge rating of 1,000 A peak. The mean voltage drop per cell is 0.5 V, the saturation current 20 mA and the peak reverse current at rated p.i.v. is from 40 to 30 mA. The forward dissipation is 30 W and the reverse dissipation varies from 1.3 to 4 W. The standard "C" series cooling fins are supplied in lengths of 2½, 5 and 7½in.

### Multi-range Test Sets

The use of germanium crystal diodes, high stability carbon resistors and printed circuit techniques in the two multi-range test sets introduced by SALFORD ELECTRICAL INSTRUMENTS, LTD., Silk Street, Manchester, 3, has resulted in instruments with high frequency response, accurate to B.S. 89 over a wide range and having low voltage drops. The sets weigh 5½ lb and have overall dimensions of 7½in by 7in by 3½in. Both models are provided with three scales, with a mirror inset and knife-edge pointer.

The "Super K" model has a.c. and d.c. voltage and current ranges up to 750 V and 7.5 A, which can be doubled by using a multiplying switch, and three resistance ranges covering up to 100 kΩ. The a.c. and d.c. voltage and current ranges for the "Super 50"

model extend to 2,500 V and 10 A, the 2,500 V range being on separate terminals. To facilitate d.c. measurements, a moving coil reversing button is fitted to avoid load change-over. The resistance ranges for this model extend to 20 MΩ. The ranges are selected by two electrically interlocked rotary multi-position switches capable of continuous rotation in either direction without mechanical interlock.

Automatic cut-out is provided for protection against accidental overload in either forward or reverse direction. The movement incorporates a critically damped moving coil system on polished, hardened steel pivots mounted in spring loaded conical sapphire jewel bearings, and operating in the gap of an "Alcomax III" permanent magnet. Accurate readings can be taken with the instrument in any position.

### Timing Unit

As an extension to their range of time delay relays, B. & R. RELAYS, LTD., Temple Fields, Harlow, Essex, have now introduced a timing unit which employs a cold cathode discharge valve. The time delay of the standard unit is from 50 milliseconds up to 2 minutes, having an accuracy within ±5 per cent, though an extended range may be achieved where required.

### Drying Cabinet

In our description of a new model of the Aerialite "Babylux" drying cabinet (*Electrical Review*, 3rd June, page 1100) it was inadvertently implied that the lid was hung on the side of the appliance when in operation. This is not so; the lid is hung on the side only when putting clothes in or removing them. When the appliance is in operation the lid is replaced on top of the drying cabinet.

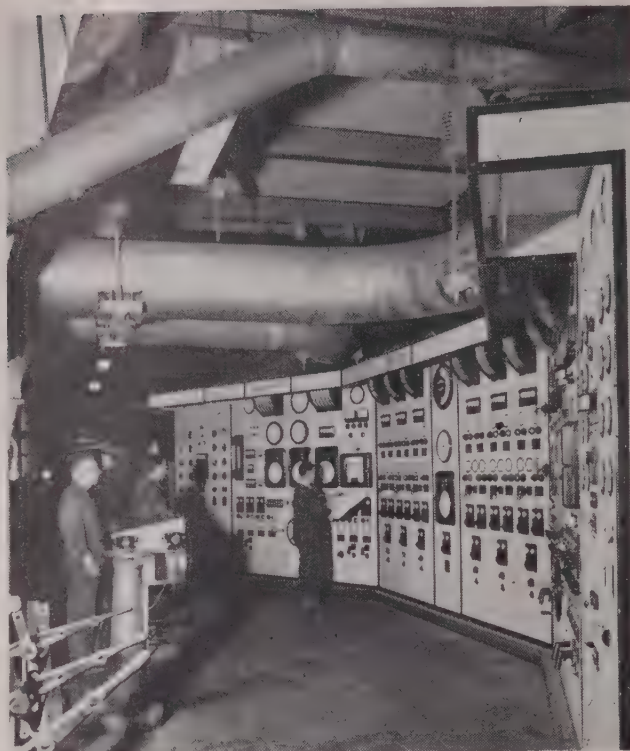


# PORTISHEAD 'B'

## CIVIC DAY

**T**O mark the completion of the Central Electricity Generating Board's Portishead "B" station a "civic day" was held last week, when the station was visited by the Lord Lieutenant of Somerset, Lord Hylton, the Sheriff and Mayor of Bristol and the M.P.s of that city, and a number of senior members of the C.E.G.B. The station, which was illustrated and described in the *Electrical Review* of 22nd June, 1956, was authorised in 1949 and the first set was commissioned in 1955, the sixth and last unit being put into commercial operation last December. The station was originally designed for six 60 MW turbo-alternators each supplied with steam from two 300 klb/hr boilers. This boiler capacity gave the equivalent of one spare boiler for the whole station. Since installation, however, the turbo-alternators have been uprated to 65 MW, making the total capacity of the station 390 MW. The station has been operating at a load factor of some 75 per cent, at which an overall thermal efficiency of about 29.8 per cent has been obtained. High boiler availability is a feature of the station, the figure for the four oil-fired boilers being some 87 per cent over the last eighteen months, including all shutdowns for maintenance, etc.

The station is situated on a long and narrow 26½-acre site adjacent to Portishead dock. Before full access could be obtained, the existing railway station and goods yard had to be re-sited half-a-mile to the south. Transit sheds and a flour mill were demolished and three 132 kV overhead lines and several 33 kV underground cables had to be diverted. The shape of the brick-clad main station building, which includes the turbine house, annexe, bunker bay and boiler house, was dictated by the site configuration and is 700ft long by 190ft wide and 135ft high. The two brick chimneys rise to 380ft above ground level. Full use of the dock facilities is made in



Combined control board for Nos. 7 and 8 coal-fired boilers

supplying the station with sea-borne coal from South Wales collieries, while road- and rail-borne coal from more local mines is also used. The working coal store has a capacity of 60,000 tons and the bunker associated with each boiler can hold 450 tons. The coaling system is designed to operate at a rate of up to 400 tons per hour. Sea-borne oil, having a viscosity of 6,000 Redwood No. 1 seconds at 100°F, can be unloaded at 600 tons/hr. The oil pipework system and storage tanks, pumps, etc., are steam trace heated to maintain the oil at a temperature of 140°F. Steam for oil heating is generated by three auxiliary 25 klb/hr oil-fired boiler units at 250 p.s.i.

### Boiler Plant

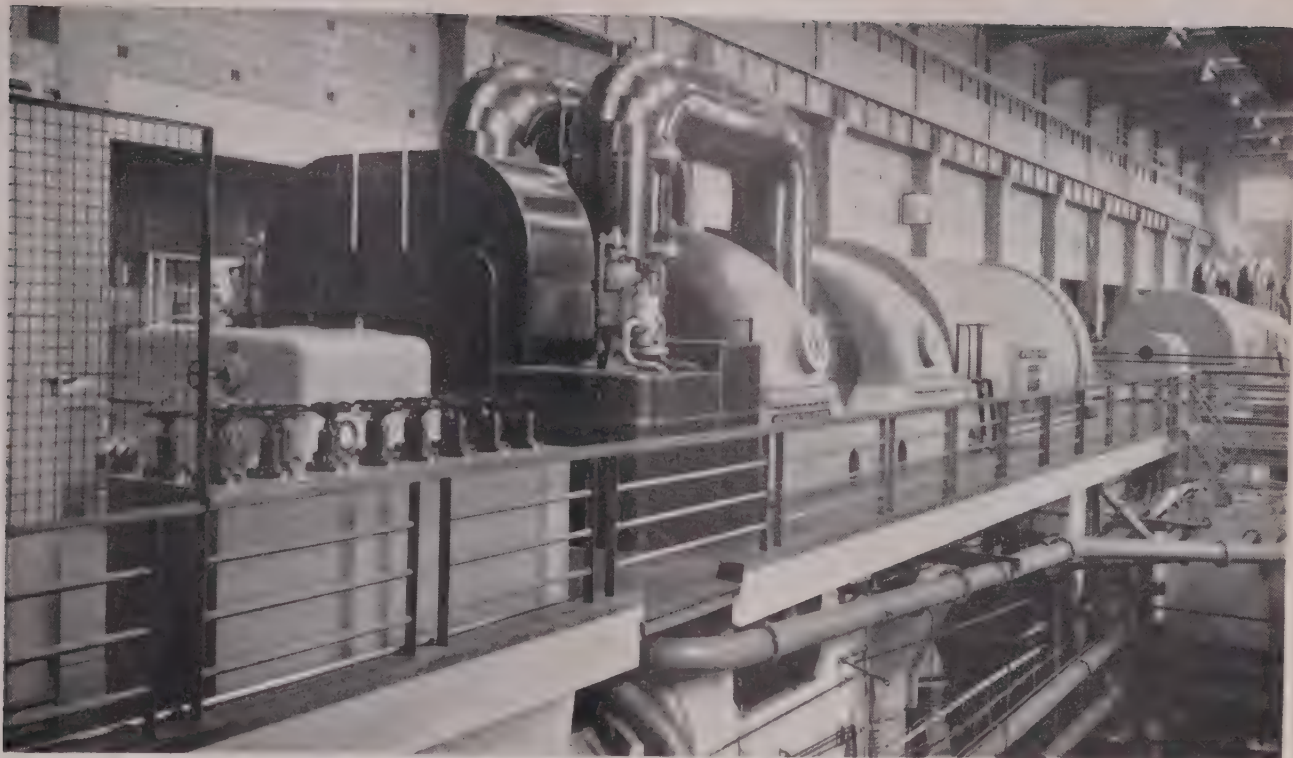
Eight of the 12 Mitchell boilers, which are arranged in a single row, are pulverised-coal fired, while Nos. 9-12 are oil fired, but provision has been made for the installation of p.f. equipment if required. The steam conditions at the superheater outlet are 950 p.s.i. and 925°F with an economiser feed temperature of 385°F. Each unit is equipped with a superheater arranged in high- and low-temperature sections in the gas path, two desuperheaters, contra-flow economisers and two rotary air preheaters, used with mechanical grit arrestors and electrostatic precipitators. Two forced draught and two induced draught fans for each unit are driven by induction-regulator-controlled variable-speed a.c. motors. Each boiler has a system of electrically-operated fully sequenced soot-blowing equipment and the Bailey superheat/control gear is arranged so that under normal operating conditions the boilers can be controlled automatically as individual units subject to a master pressure control common to each pair and to a unit sensitive to the steam flow from each individual boiler. Clinker from the wet ash hopper below each furnace and dust from the

### THIS STATION WAS ORIGINALLY DESCRIBED IN OUR ISSUE OF 22 JUNE 1956

Since that date comprehensive descriptions of other stations under construction have been published in the following articles specially prepared by our technical staff

Keadby	13/7/56	Willington "A"	8/8/58
Stella North	20/7/56	High Marnham	22-29/8/58
Castle Donington	28/6/57	Ferrybridge "B"	3/10/58
Hams Hall "C"	12/7/57	Blyth "A"	27/2/59
Machynlleth "B"	19/7/57	Kincardine	15/5/59
Tilbury	2/8/57	Bold "B"	11/9/59
Barony	6/9/57	Little Barford "B"	13/11/59
South Denes	20/6/58	Drakelow "B"	18/12/59
Rogerstone	25/7/58	Ffestiniog	26/2/60





*This view of the turbine hall shows No. 4 turbo-alternator set in the foreground*

economiser hoppers and dust extraction equipment are removed by a high-pressure sluicing system to settling ponds and are taken by lorries to ash disposal grounds which are being raised by some 18ft, with the top soil replaced for agricultural use.

The six 3,000 r.p.m. hydrogen-cooled Metropolitan-Vickers turbo-alternators are arranged longitudinally in the turbine room in pairs with the steam ends of adjacent machines facing. The designed steam conditions are 900 p.s.i. and 900°F at the turbine stop valve with 28.9in Hg of vacuum. The turbines are two-cylinder units with the high- and low-pressure rotors rigidly coupled. The cylinders are provided with annular steam belts enabling steam to be withdrawn from the complete periphery to preserve thermal balance. Each set is provided with emergency stop and governor valves of the balanced pressure type and load up-off gear is fitted to reduce the load automatically should the vacuum fall below 25in Hg while, if the steam pressure in the turbine falls below 90 per cent of the normal value, pressure-operated unloading gear reduces the steam demand. Each turbine exhausts to a single horizontal condenser having a cooling surface of 58,600 sq ft. Special protective treatment has been given to the manifolds and condensing water boxes because of serious graphitic corrosion problems experienced and the water boxes are also electrically insulated from the condensing tube plates.

The tidal variation of over 50ft in the Severn estuary—the second highest in the world—has resulted in an unusual

water circulating system. Four culverts from a dredged channel connect to three 45ft diameter 79ft deep pump pits, one between each pair of turbo-alternators. Each pit houses four pumps, shaft driven from 460 h.p. motors mounted at the turbine house basement level some 75ft above the pumps. A manifold pipework system at the bottom of each pit with remotely controlled hydraulically-operated valves enables any culvert to be used for intake or discharge of water. This is necessitated by the water flow conditions in the estuary. The station requires 18 million gallons of circulating water per year. To give maximum advantage to the siphonic action of the returned water to the culverts under low-water conditions, the condensers are situated some 40ft below the basement level. The tidal volume to be exhausted when raising vacuum is 1,770 cu ft and the



*The main control room*



equipment is designed to enable the sets to run up to speed in approximately 40 min, using a steam exhauster and two three-stage steam ejectors.

Each of the alternators, which are cooled by hydrogen at a pressure of 0.5 p.s.i. for sets Nos. 1-4 and 15 p.s.i. for sets 5 and 6, is solidly coupled to a 72 MVA generator transformer, the h.v. side of which is connected to the 132 kV grid switching station on the opposite side of Portishead dock by a 0.25 sq in three-core gas-filled cable. These cables pass under the entrance lock to the dock through two 8ft diameter tunnels at a depth of 82ft. The leads to the generator transformer can be attached and a connection made to the 6 MVA unit transformer, providing a starting supply for the station, should the "A" station from which starting supplies are normally obtained be completely shut down. The cast iron linings of the three pump pits and the two cable tunnels are being used for station earthing to meet the low resistance to ground value required by the G.P.O.

## Cable Soil Classification

AN extremely simple system of soil classification for use in the field is proposed in E.R.A. Report Ref. F/T198, 1960, by M. J. Vanner, price 10s 6d plus postage. It is based on visual inspection of the soil, combined with the determination of certain soil properties by manipulating the samples in the hand. It saves time and expense when compared with the rigorous civil engineering classifications which require laboratory tests. A carefully controlled trial of the system has shown that it provides a valid method of classifying and identifying those types of soil of interest to cable engineers into broad divisions determined by the basic structure of the soil. The system can provide a uniform terminology which may be used when cable sites are being investigated.

Soil thermal properties play an important part in the control of the loading capacity of buried power cables and will become of even more importance if greater utilisation is made of the cables, as rigorous control of the cable environment will have to be maintained. The use of this simplified system of classification should advance the time when cable engineers will be able confidently to predict the behaviour of the soil environment of buried cables.

Though designed especially for use by cable engineers, the system of classification may also be of use in providing uniform terminology in other electrical engineering fields, in particular for the field classification of soils in which overhead line tower foundations are buried.

## SOUTH AFRICAN NEWS

*From our Cape Town Correspondent*

REFRIGERATED air conditioning is being used to an increasing extent in South African factories and office blocks in the regions in which the summer temperatures rise to uncomfortable levels. Most of the new commercial and industrial buildings in such cities as Pretoria and Durban now have air conditioning. Such offices are easier to let than those not so up-to-date in this regard. In general, central plant is preferred, not only because the inclusive

cost of the service is lower but because in the main such plant has a much longer life than small individual units. There is also the consideration that the noise of the individual air conditioner may prove a distraction in an office.

In the sale of industrial refrigeration equipment in South Africa, it is usual for engineering machinery importing firms to represent manufacturers, bringing in the equipment on their own account. They usually provide customers at least with an advisory service, but also assume responsibility for installing and later servicing the equipment. In the commercial refrigeration trade there are wholesalers who import directly and are sole distributors of certain lines. Their customers are the refrigeration contractors. The larger contractors also undertake a certain amount of local manufacture and assembly in addition to distributing and installing equipment. The larger contractors import most of their requirements themselves and sell direct to the users.

A Johannesburg company has informed the Department of Commerce and Industries that it is manufacturing small-sized refrigerators for which there is an ever-increasing demand. Extensive tests were carried out with different types of absorption units and finally a unit was found that stood up to the high temperatures and humidity experienced, particularly at the coast.

Speaking in Cape Town recently, Mr. D. H. C. du Plessis, general manager of South African Railways, said that a new era had begun for the railways in which mechanisation and automation would play the major part. The modernisation programme, he said, would cost "the best part of £600 million." The trend was for all main-line trains to be either electrically operated or hauled by diesel locomotives.

## PATENT OFFICE REPORT FOR 1959

THE continued increase in 1959 in applications for patents and trade marks and in applications from other countries, including the Soviet Union, are referred to in the 77th annual report of the Comptroller-General of Patents, Designs, and Trade Marks (H.M. Stationery Office, price 1s 6d).

The continued rise in applications and the difficulty in recruiting staff have led to a substantial arrear of unexamined patent specifications, although this has not increased as quickly as the number of applications. Applications for trade marks continue to increase partly, it is thought, because of the increased advertising of consumer goods and a tendency to seek a trade mark for each new line rather than a mark covering a whole range of goods. It is becoming increasingly difficult, the report states, to find a good trade mark which is acceptable within the provisions of the Act and the work falling upon the Trade Marks Registry is, therefore, increasing faster than the number of applications would suggest.

Among electrical inventions, a new departure was the thermionic conversion of heat direct to electricity, in so-called "thermionic engines." Fuel cells, inductive signalling as applied to hospital and factory paging systems, and electric analogue computers for machine tool control systems and other purposes remained active. Interest was also shown in the programme control of machine tools, particularly copy milling machines, by a punched card or tape or by a magnetic tape. The materials, construction and loading of fuel elements for nuclear reactors, and the treatment of spent nuclear fuels, received increased attention.

Mention is also made of the committee which is considering the law relating to industrial designs and of international discussions in the field of industrial property.



**NEW**

## Dubilier Power Factor Correction Capacitors for fluorescent street lighting.



Dubilier Duconol Power Factor Correction Capacitors for fluorescent street lighting are subjected to stringent testing to ensure absolute reliability. These capacitors are sturdily built, hermetically sealed, completely leakproof and are suitable for satisfactory use at their rated voltage up to temperatures of 70°C thereby reducing maintenance cost to the absolute minimum.

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# DUBILIER

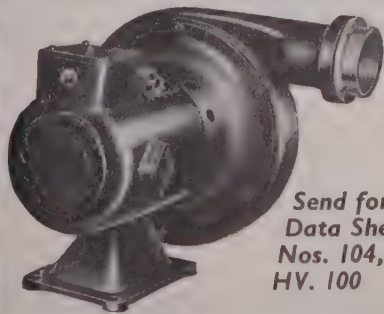
**Dubilier Condenser Co. (1925) Ltd.,  
Ducon Works, Victoria Road,  
N. Acton, London, W.3.**

Tel: ACO rn 2241 (5 lines) Grams: Hivoltcon London Telex. Telex: 25373 Cables: Hivoltcon London.

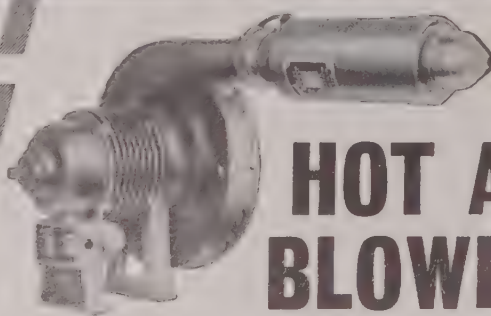
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**SERVICE ELECTRIC CO. LTD. HOBLEY OF WARE - STANMORE HEDDLE HIGGINS 5566/2**

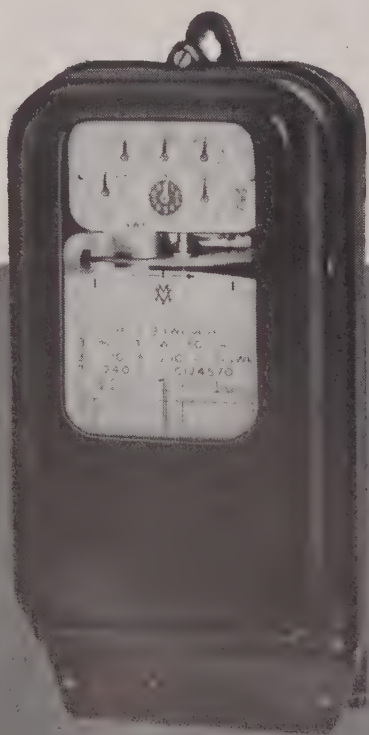


# Accent on Accuracy

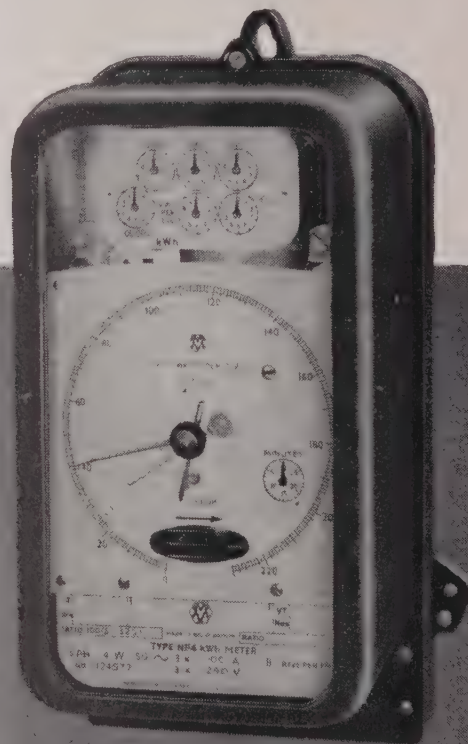
## WITH THE TYPE NF SERIES

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Their easily accessible adjustments, lightweight construction and handsome appearance, will commend themselves to all users. The meters comply in all respects with British Standard 37: Part 4: 1954 and Part 5: 1955.



Type NF3 two-element watt-hour meter



Type NF4 three-element maximum demand meter

For further information please write for 'The Art of Metering', which gives full details of these meters, to your local A.E.I. office or direct to:



**Associated Electrical Industries Limited**  
**INSTRUMENTATION DIVISION - Instrument & Meter Department**  
**Trafford Park, Manchester 17**

# GENERATION AND DEVELOPMENT

## 380 kV Transmission

The 64-mile-long transmission line between High Marnham, Notts., and Monk Fryston, near Leeds, which is at present operating at 275 kV, will be uprated to 380 kV in about two years' time for experimental purposes. The Central Electricity Generating Board has just placed the orders for the two terminal auto-transformers. These transformers, one of which is being supplied by the English Electric Co., Ltd., and the other by Ferranti, Ltd., will each cost £250,000. Each unit will be rated at 275/380 kV, 400 MVA.

## Objections to 275 kV Line

A Ministry inquiry is to open at Jarrow (Co. Durham) next Tuesday into a proposal by the Central Electricity Generating Board to erect a 275 kV line through the area. The scheme is part of a new transmission line from Blyth power station to North Yorkshire. Four alternative routes have been suggested and all are being opposed.

## Hay Drying Demonstration

The Electrical Development Association staged a comprehensive in-barn hay drying installation at the National Grassland Management Demonstration, which was held at Hatch Warren Farm, Cliddesden, near Basingstoke, on 8th and 9th June, and at which all aspects of grassland management and conservation were covered. The electrical exhibit, which was housed in a 4-bay dutch barn, consisted of two main parts. One comprised a full-scale working demonstration of a 2-bay batch bale hay dryer, complete with mechanised handling from dryer to storage area. In this dryer the ventilating air is provided by three axial flow fans. A light-weight elevator-conveyor recently introduced into this country from America demonstrated the loading of the dryer and also the unloading and conveying of the dried bales to a "tumble store" at the far end of the barn.

The remainder of the barn was devoted to alternative methods of electric drying. These covered "batch" drying on platforms and in tunnels together with "storage" drying methods. A range of typical equipment for the various methods was also on view.

## Huddersfield Service Centre

The Yorkshire Electricity Board's service centre at Market Street, Huddersfield, has recently been

*The modernised service centre of the Yorkshire Electricity Board at Huddersfield*

modernised, and the accompanying photograph shows the extensive floor space which is available for the display of a wide range of domestic appliances. Other important features are the improved facilities for consumers' inquiries and payment of accounts and the new demonstration room which is connected with the service centre. The attention of the passers-by is attracted by the semi-vista windows which provide views of the interior. The design of the interior was carried out by the Board's staff.

## Development in Cornwall

The South Western Electricity Board is spending over £830,000 this year to keep pace with development in Cornwall where the demand for more power supplies is greater than ever before. This was stated at Truro by Mr. S. F. C. Whitmore, the Board's deputy chairman, recently before the official opening of the reconstructed electricity service centre there by the Mayor, Councillor W. J. Bowden. Mr. Whitmore said that last year some 3,550 new consumers had been connected in Cornwall, including nearly 500 farms. He pointed out that there were now nearly 6,800 farms in Cornwall connected to the mains, of which approximately 4,650 had been connected since nationalisation. This year the Board planned to connect just under 1,400 rural premises (including 540 farms) in the Duchy.

## OVERSEAS

### Priest Rapids Failure

A fault that has developed in one of the 230 kV, 183 MVA generator transformers at the Priest Rapids hydro-electric station in the United States will necessitate modifications to all five units supplied by the English Electric Co., Ltd. The faulty transformer will be shipped back to



England for repair but the work on the other units will be done at the company's Canadian factory. In the meantime two of the transformers are being kept in service on reduced load, and discussions have been going on in London this week to decide what action can be taken to keep the station in operation. It is understood that there is no question of the faulty transformers being replaced by units of American manufacture.

The English Electric Co. had delivered the transformers to Priest Rapids well in advance of the scheduled completion date. The penalty "deadline" is one year later and it is anticipated that the modifications will be completed before this is reached.

### New Swedish Reactor

Sweden's third reactor, R2, was started up recently at AB Atomenergi's research station, Studsvik, on the Baltic coast south of Stockholm. R2, which has cost about £2.2 million, is intended for testing materials and developing fuels for forthcoming large power-producing reactors.

### Beloyarsk Nuclear Station

It is reported that the assembling of the reactor has begun at the Russian Beloyarsk nuclear power station, which is under construction in the Urals. The capacity of the station will be 200 MW (electrical). The reactor is a graphite cylinder 30ft high and 29½ft diameter with 998 uranium fuel channels. It is surrounded by a water-filled reservoir for radioactive radiation protection. There is also a 3½ft reinforced concrete protective shield. The reactor will be controlled from an underground panel 23ft below the surface.



## NEW PATENTS

## Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

## 1955

3599. National Research Development Corporation.—Piezo-electric transducers. 7th May, 1956. (835691.)

4072. Henley's Telegraph Works Co., Ltd., W. T.—Apparatus for handling bodies of indefinite length. 10th May, 1956. (836352.)

7395. Phoenix Telephone & Electric Works, Ltd.—Staff call system. 14th June, 1956. (835692.)

9925. Plessey Co., Ltd.—Electrical capacitors. 6th June, 1956. (836392.)

14834. British Thomson-Houston Co., Ltd.—Electric rectifiers employing semiconductor. 11th May, 1956. (835993.)

19078. English Electric Co., Ltd.—Electric motor control systems. 2nd July, 1956. (835996.)

19080. English Electric Co., Ltd.—Electrical protective relay systems. 2nd July, 1956. (836400.)

20049. British Telecommunications Research, Ltd.—Automatic telephone systems. 11th July, 1956. (836557.)

22425. Automatic Telephone & Electric Co., Ltd.—Circuit arrangements for converting a first representation of a digit into a second representation. 13th July, 1956. (835871.)

22645. British Thomson-Houston Co., Ltd.—Assembly of electric rectifiers. 3rd August, 1956. (836401.)

22956/7. General Electric Co., Ltd.—Electric discharge lamps. 18th July, 1956. (836551/2.)

24494. Hivac, Ltd.—Cold cathode gas discharge tubes. 21st August, 1956. (836402.)

24573. English Electric Co., Ltd.—Electric motor control systems. 17th August, 1956. (836000.)

26843. English Electric Co., Ltd.—Circuit-breaker indicator systems. 14th September, 1956. (836403.)

27098/9. British Thomson-Houston Co., Ltd.—Controlling systems for electric motor equipments. 18th September, 1956. (835732/4.)

28515. British Thomson-Houston Co., Ltd.—Electromagnetic systems for measuring or indicating clearances between relatively movable parts. 4th January, 1957. (836116.)

28646. British Scientific Instrument Research Association, and Martin, D. J. R.—Electrical conversion devices, using vibratory interrupters. 12th December, 1956. (836353.)

28969. British Insulated Callender's (Submarine Cables), Ltd.—Manufacture of multicore electric cables. 10th October, 1956. (835873.)

36172. British Thomson-Houston Co., Ltd.—Method of making a non-rectifying contact to germanium. 13th December, 1956. (836191.)

36403. Clayton Crane & Hoist Co., Ltd.—Electric conductor rail or wire systems with trolley collectors. 14th December, 1956. (835698.)

## 1956

976. Automatic Telephone & Electric Co., Ltd.—Electrical components mounting arrangements. 24th December, 1956. (836405.)

3141. Clayton Crane & Hoist Co., Ltd.—Electric conductor rail or wire systems with trolley collectors. 20th December, 1956. (835699.)

5786. English Electric Co., Ltd.—Piezo-electric accelerometers. 20th February, 1957. (836194.)

11623. National Research Development Corporation.—Cathode-ray tubes. 17th April, 1956. (836007.)

12127. Babcock & Wilcox, Ltd.—Nuclear reactor fuel element handling plant. 18th April, 1957. (836562.)

12524. Metropolitan-Vickers Electrical Co., Ltd.—Electronic digital computers. 9th April, 1957. (835879.)

12803. English Electric Co., Ltd.—Temperature measuring devices. 25th April, 1957. (835551.)

12886. National Research Development Corporation.—Cathode-ray tubes. 26th April, 1956. (836008.)

13834. International Computers & Tabulators, Ltd., formerly British Tabulating Machine Co., Ltd.—Electrical signalling apparatus. 4th May, 1956. (836360.)

1584/5. British Insulated Callender's Cables, Ltd.—Apparatus for reeling electric cables and other elongated flexible articles. 17th May, 1957. (836411/2.)

17009. Associated Electrical Industries, Ltd.—Vacuum pumps. 22nd May, 1957. (835885.)

17229. Mechanical Products, Inc.—Electric circuit-breakers. 4th June, 1956. (835554.)

18404. Telefunken G.m.b.H.—Electromagnetic deflecting coils for cathode-ray tubes. 14th June, 1956. (835741.)

18676. Glover & Co., Ltd., W. T.—Wiped metal joints and their manufacture. 14th June, 1957. (835742.)

20063. General Electric Co.—Apparatus for reproducing images in colour. 28th June, 1956. (836015.)

21259. Morgan Crucible Co., Ltd.—Electric current collecting brushes. 1st July, 1957. (836420.)

21370. Airtron, Inc.—Method of making high frequency power dissipating terminations. 10th July, 1956. (836421.)

21913. Schneider, H., and Mattes, C.—Electric switch arrangements for protecting plant against unauthorised use. 16th July, 1956. (836018.)

22219. Philco Corporation.—Cathode-ray tubes. 18th July, 1956. (835789.)

22987. Licentia Patent-Verwaltungs-G.m.b.H.—Magnetic voltage regulators for transformers with stepped switching mechanisms. 25th July, 1956. (836019.)

23476. General Electric Co.—Voltage measuring apparatus. 30th July, 1956. (836425.)

24802. Babcock & Wilcox, Ltd.—Material handling plant, more particularly plant for handling nuclear reactor fuel elements. 14th August, 1957. (836563.)

24844. United Kingdom Atomic Energy Authority.—Heterogeneous nuclear reactors. 1st August, 1957. (835764.)

24889. International Business Machines Corporation.—Magnetic storage elements. 14th August, 1956. (836426.)

25251. Sperry Rand Corporation.—Gating circuits using transformers. 17th August, 1956. (836027.)

25670. James, W. D. M., and James, K. V. R. (trading as James Bros.).—High voltage supply units. 16th August, 1957. (836427.)

29574. Siemens-Schuckertwerke A.G.—Manufacture of commutators and slip-rings for electrical machines. 27th September, 1956. (835768.)

30058/9. General Electric Co., Ltd., and Waymann, C. J.—Electrical servo-systems. 2nd October, 1956. (836432/3.)

30149. General Railway Signal Co.—Electronic track circuit for railroads. 3rd October, 1956. (836434.)

32097. Philips Electrical Industries, Ltd.—Relay circuits employing semiconductor

devices for generating multiple pulses. 22nd October, 1956. (835710.)

32263. Kienzie Apparate G.m.b.H.—Devices for counting and shaping electrical pulses. 23rd October, 1956. (835562.)

33514. Soc. Générale de Constructions Electriques et Mécaniques Alsthom.—Control of electric traction motors. 2nd November, 1956. (836130.)

34590. Siemens-Schuckertwerke A.G.—Controllable electric converters employing semiconductor elements. 12th November, 1956. (835094.)

34697. Compagnie Générale de Télégraphie sans Fil.—Ultra high frequency switches. 13th November, 1956. (835905.)

36287. General Electric Co., Ltd.—Electric communication systems. 22nd November, 1957. (836037.)

36288. General Electric Co., Ltd.—Temperature control arrangements. 19th November, 1957. (835684.)

36698. Sperry Rand Corporation.—Use of ferrite members in microwave conductors. 30th November, 1956. (836440.)

37038. Philips Electrical Industries, Ltd. Systems comprising transistor memory elements. 4th December, 1956. (835907.)

37244. Rolls-Royce, Ltd.—Electrically driven actuating mechanisms. 29th November, 1957. (835775.)

38104. General Electric Co.—Electron discharge devices. 13th December, 1956. (836038.)

38108. General Electric Co., Ltd.—Seals comprising a ceramic or metal member sealed to a ceramic, metal or glass member. 13th December, 1957. (836215.)

38287. Standard Telephones & Cables, Ltd.—Multiplexing and filtering device for the u.h.f. band. 14th December, 1956. (Addition to 769668.) (835575.)

1957  
713. Standard Telephones & Cables, Ltd.—Travelling wave tubes. 8th January, 1957. (836219.)

1550. Siemens Edison Swan, Ltd.—Jointing of glass parts. 9th January, 1958. (836134.)

1937. Philips Electrical Industries, Ltd.—Circuit arrangements for use in television receivers. 18th January, 1957. (835585.)

3878. United Kingdom Atomic Energy Authority.—Waveguide structures. 31st January, 1958. (Cognate application 4843, 13th February, 1957.) (835711.)

4592. Philips Electrical Industries, Ltd.—Structures embodying electric fittings. 11th February, 1957. (836445.)

5238. Philips Electrical Industries, Ltd.—Devices comprising a cathode-ray tube for producing a signal delay. 15th February, 1957. (836446.)

5359. Neill, O. S.—Method and apparatus for finding faults in a plurality of conductors. 18th February, 1957. (836041.)

5906. General Electric Co., Ltd.—Apparatus for feeding lamp filament leads and like articles. 14th May, 1958. (835921.)

6660. Automatic Telephone & Electric Co., Ltd.—Subscribers' line circuits. 16th January, 1958. (836225.)

6972. General Electric Co., Ltd.—Electric motor control arrangements. 25th February, 1958. (Cognate application 30543, 30th September, 1957.) (Addition to 774691.) (835924.)

7099. Metropolitan-Vickers Electrical Co., Ltd.—X-ray generating apparatus. 25th February, 1958. (836447.)

7352. Plow, R. S. S.—Electric water heater. 22nd October, 1957. (836448.)

[Continued on page 1191]

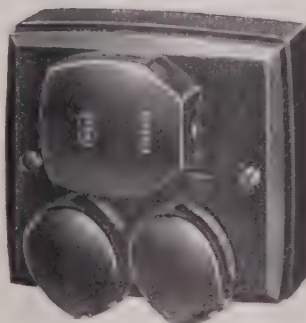


# Electrical accessories from the

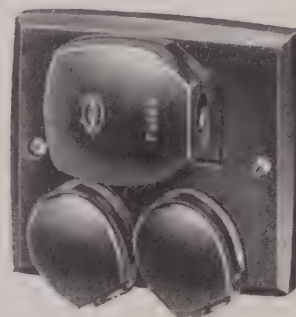
# MEM range



- Three outlets in one—yet only slightly larger than a single 13 amp. socket outlet.
- One 13 amp. 3-pin (flat) and two 2 amp. 3-pin (round) outlets, the latter being protected by a B.S. 646 cartridge fuse-link which can be replaced from front.
- Supplied complete with three plugs.
- Brown or ivory finish.
- Steel boxes with knockouts or spout entry.
- Flush pattern convertible to surface pattern by means of pattress.
- Backing plate to comply with I.E.E. regulation 207G.



133 BOF with 133 PTB



133 BOF

## MEM triple socket outlet

- 20 amp. 250 volt D.P., A.C. only.
- Switches are of rocker dolly type.
- Neon pilot lamp visible over wide angle.
- All insulated. Suitable for direct mounting into B.S. 1299 box.
- Brown or ivory finish.
- Flush pattern convertible to surface pattern by means of pattress.
- Backing plate to comply with I.E.E. regulation 207G.
- The unit can be engraved "Water Heater" when required.



20 SBNF/WH with 12 PTB



20 SBNF

## MEM water heater switch

The full range is detailed in the new MEM 88-page Catalogue. Send for your copy, list No. 435 R., today.





# THE FUSES TO USE-

## WHEN AND HOW TO USE THEM

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We shall be pleased to forward a copy of list CFL on request.



# *Parmiter Hope & Sugden Ltd.*

**FLUVENT ELECTRICAL WORKS**  
London: 34 Victoria Street, S.W.1.

**LOW SIGHT**  
Glasgow: 5 Somerset Place, C.3.

**MANCHESTER 12**  
Birmingham: 39/41 Carrs Lane, 4.

## NEW PATENTS (continued)

9350. Thorn Electrical Industries, Ltd.—Temperature sensitive materials. 28th May, 1958. (835786.)

9442. General Electric Co.—High current rectifier. 22nd March, 1957. (836370.)

9978. Ciang, Ltd., Austen, H. E., and Harwood, C. D.—Electrical plug and socket couplings. 27th March, 1958. (836565.)

11903. Permutit Co., Ltd.—Electrolytic cells. 3rd April, 1958. (Addition to 824929.) (836042.)

12025. English Electric Valve Co., Ltd.—Electron discharge tubes. 30th January, 1958. (836229.)

12403. Pye, Ltd.—Deflection coil assemblies for cathode-ray tubes. 9th April, 1958. (836230.)

12618. United Kingdom Atomic Energy Authority.—Support structures for nuclear reactor fuel elements. 11th April, 1958. (836043.)

13349. Western Electric Co., Inc.—Electrical comparator network. 26th April, 1957. (836234.)

13350. Electron beam positioning apparatus. 26th April, 1957. (836235.)

13351. Apparatus for establishing the position of a point source of light, such as the light spot formed by an electron beam on the screen of a cathode-ray tube. 26th April, 1957. (836236.)

13352. Electrical comparator network. 26th April, 1957. (836237.)

14108. Stauffer Chemical Co.—Electrically heated vacuum furnaces. 3rd May, 1957. (836141.)

14354. General Electric Co., Ltd.—Electric pulse lengthening apparatus. 30th April, 1958. (835602.)

14927. Murex Welding Processes, Ltd.—Electric arc welding. 28th April, 1958. (835720.)

15367. Plessey Co., Ltd.—Fission product separator for liquid reactor systems. 12th May, 1958. (836047.)

18690. Philips Electrical Industries, Ltd.—Radiators for short-wave devices. 13th June, 1957. (835944.)

19024. General Electric Co., Ltd.—Refractory ceramic materials. 17th June, 1958. (835798.)

19636. General Electric Co., Ltd.—Electric lighting fittings incorporating spotlight reflectors. 10th April, 1958. (836055.)

19908. United Kingdom Atomic Energy Authority.—Cooling of nuclear reactors. 24th June, 1958. (835947.)

20247. Union Carbide Corporation.—Gas diffusers for electric batteries. 27th June, 1957. (836457.)

20739. Decca Record Co., Ltd.—Electromagnetic deflection circuits for cathode-ray tubes. 30th September, 1958. (836060.)

23011. Siemens & Halske A.G.—Semiconductor devices and methods of producing such devices. 19th July, 1957. (836066.)

24421. Peters, L. H.—Electric lighting fittings. 1st August, 1957. (835619.)

25281. Sinclair, N.—Device for interposing between a cathode-ray tube and its socket for improving performance. 29th July, 1958. (836161.)

25579. Ericsson Telephones, Ltd.—Lock-out circuits. 13th August, 1958. (836467.)

26527. General Railway Signal Co.—Protection of electronic apparatus from current and voltage surges. 22nd August, 1957. (836435.)

27500. Union Carbide Corporation.—Electric graphitising furnaces. 28th August, 1957. (835953.)

28034. Best & Lloyd, Ltd.—Mounting for electric lamps. 20th August, 1958. (836163.)

29061. General Electric Co., Ltd.—Operating arrangements for electrical discharge lamps. 12th September, 1958. (836252.)

30970. Revo Electric Co., Ltd.—Street lighting fittings. 1st October, 1958. (836376.)

31001. Parmeko, Ltd.—Magnetic cores for transducers and/or saturable reactors. 2nd October, 1958. (835818.)

32519. Svenska Relafabriken A.B.—Electric switching devices. 17th October, 1957. (835965.)

33233. Brown, Boveri & Cie. A.G.—Electrical regulating systems. 24th October, 1957. (835966.)

33323. Energieversorgung Erfurt Veb.—Apparatus for the thermo-electrical measurement of infra-red radiation. 25th October, 1957. (836476.)

34461. Western Electric Co., Inc.—Multi-conductor electrical cables. 5th November, 1957. (836255.)

34894. Western Electric Co., Inc.—Electrical inductance devices and magnetisable cores therefor. 8th November, 1957. (836257.)

36328. Chloride Batteries, Ltd.—Tubular type plates for electric accumulators. 10th October, 1958. (836262.)

36386. Siemens & Halske A.G.—Telecommunications systems, for example telephone installations. 21st November, 1957. (836383.)

36872. General Electric Co., Ltd.—Transistor operated relay circuits. 26th November, 1958. (836074.)

37017. Welwyn Electrical Laboratories, Ltd., and Whitfield, E. H.—Actuators for electrical switches. 27th November, 1957. (836264.)

38552. Siemens-Elektrogeräte A.G.—Portable electrical communication instruments. 11th December, 1957. (836384.)

38903. Smit & Co.'s Transformatoren-fabrik N.V., W.—High tension transformers having screens for the potential control. 13th December, 1957. (836271.)

39047. Murray, J. S.—Crystal-controlled oscillator circuits. 16th December, 1958. (835971.)

39341. Claude Paz et Visseaux.—Electric discharge devices. 18th December, 1957. (Addition to 816054.) (835831.)

39551. Jungfer, L. (trading as Akkumulatorenfabrik Dr. L. Jungfer).—Separators for electric accumulators and processes for manufacturing such separators. 19th December, 1957. (835728.)

1958

40344. Philips Electrical Industries, Ltd.—Cathode-ray tubes for colour reproduction. 15th December, 1958. (835688.)

## TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

25th June

**Martindale.** No. 773,725. Class 7. Electrically operated spray guns and pressure containers and air compressors for use therewith; electric and pneumatically operated circular saws and grinding machines for the mica undercutting of commutators; and electrically operated hand engraving tools.

**Martindale.** No. 773,726. Class 8. Grinding implements for use on commutators; and electricians' pocket knives incorporating screwdriver blades, wire scrapers and files.

**Martindale.** No. 773,727. Class 9. Electric vacuum cleaning apparatus, portable electric blowers, electric converters (vibrators), and instruments for testing voltage; electric devices for magnetising, demagnetising and for testing the continuity of electrical circuits, etc.

**Martindale.** No. 773,728. Class 11. Electric air heating devices for attachment to the nozzles of electric blowers and of air compressors.—Martindale Electric Co., Ltd., Westmoreland Road, N.W.9.

**Electromatic.** No. 797,271. Class 7. Electrically operated washing machines, centrifugal drying machines, rinsing machines, and mixing machines.—Continental Washing Machine Co., Ltd., 63, Great Eastern Street, London, E.C.2.

**Novum** (design). No. 796,521. Class 7. Electric washing and drying machines; and darning, knitting and sewing machines.—Novum, Ltd., Dublin. Address for service, c/o H. D. Fitzpatrick & Co., 3, Gray's Inn Square, London, W.C.1.

**Twin-Matic.** No. 802,224. Class 7. Combined washing and drying machines.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

**Inferation.** No. 793,310. Class 9. Electrically heated clothing; and electric saucepans and frying pans. **Inferation.** No. 793,311. Class 10. Electrically heated belts for medical purposes, electric thermo-compresses (surgical); electrically heated blankets and incubators for babies. **Inferation.** No. 793,312. Class 11. Electrically heated apparatus for demisting windows; and electrical apparatus for heating, drying and cooking.—Inferation, Ltd., Stanhope Road, York Town Industrial Estate, Camberley, Surrey.

1st July

**Hipol.** No. 782,502. Class 9. Electrical capacitors.—Dennison Development, Ltd., 222, Soho Hill, Handsworth, Birmingham, 19.

**Varamag.** No. 792,997. Class 9. Electric transformers, magnetic amplifiers; and electrical and electronic apparatus and instru-

ments, and parts.—Lancashire Dynamo Nevelin, Ltd., Holland Road, Hurst Green, Oxted, Surrey.

**Biclef.** No. 797,970. Class 9. Covered electric wire and electric cables; and electric conduits.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, S.W.18.

**Syntap.** No. 799,527. Class 9. A.c. voltage regulators incorporating one or more semiconductor devices.—Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, London, N.1.

**Brillion.** No. B801,216. Class 9. Cathode ray tubes for television receivers, and parts.—Enfield Electronics (C.R.T.), Ltd., 5, Station Close, Potters Bar, Middx.

**Cosistat.** No. 802,582. Class 9. Thermostats.—Drayton Regulator & Instrument Co., Ltd., Horton Lane, West Drayton, Middx.

## NEXT WEEK'S EVENTS

*Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that dates for their functions do not clash with others already arranged*

**SUNDAY, 19th JUNE to TUESDAY, 21st JUNE**

**Scarborough.**—Electrical Contractors' Association. Annual conference.

**MONDAY, 20th JUNE**

**Bristol.**—Grand Hotel, 7.45 p.m. A.S.E.E. Bristol and West of England Branch. Annual general meeting.

**Hove.**—At the offices of the S.E.E.B., 10, Queen's Gardens, 6 p.m. E.I.B.A. Sussex Centre. Annual general meeting.

**MONDAY, 20th JUNE to THURSDAY, 23rd JUNE**

**London.**—Royal Horticultural Society's New Hall, Westminster, S.W.1. Laboratory Apparatus and Materials Exhibition.

**THURSDAY, 23rd JUNE**

**Croydon.**—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "Heat Storage," by R. Jackson.

**London.**—Royal Festival Hall, 7.30 p.m. Institution of Electrical Engineers. Institution Conversazione.

**FRIDAY, 24th JUNE**

**Coventry.**—E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane, 7.45 p.m. A.S.E.E. Coventry and District Branch. Films "Installing Armoured Cables."



# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

**Antrim.**—R.D.C. 29th June. Supply and erection of fluorescent lamps at Muckamore and Templepatrick. Clerk's Office, The Steeple, Antrim.

**Australia.**—Postmaster General's Department, Melbourne. 20th October. Radio relay systems for television and telephony. (E.S.B. 14669/60.)\*

Western Australian Government Tender Board, Perth. 7th July. Two 5,000 kVA, 66/22 kV tap changing transformers. (E.S.B. 15138/60.)\*

Electricity Commission of New South Wales, Sydney. 11th July. Two 30 MVA, 132 kV transformers. (E.S.B. 15376/60.)\*

**Ayr.**—County Council. Trunk road lighting equipment. (See this issue.)

**Belfast.**—Corporation. Passenger lifts for two blocks of flats. (See this issue.)

**Cardiff.**—City Council. 13th September. Pumps, motors, switchgear and other electrical plant for two pumping stations. Engineer's Office, Sluvad, Panteg, near Pontypool.

**Costa Rica.**—La Proveeduría, Instituto Costarricense de Electricidad, San José. 23rd June. Aluminium conductor cable. (E.S.B. 15149/60.)\*

**Dagenham.**—Corporation. 2nd July. Electrical installations in 190 dwellings, Canvey Island development. (See this issue.)

**Darlington.**—R.D.C. 8th July. Three recirculation pump sets with electric motors, Aycliffe sewage disposal works. Arnold Brooksbank & Son, consulting engineers, 48, Sunbridge Road, Bradford, I.

**Dudley.**—Corporation. 24th June. Street lighting equipment. (See this issue.)

**Durham.**—County Council. Electrical installation at Easington Technical College and Peterlee County Library. (See this issue.)

**Formosa.**—Central Trust of China, Taipei. 5th July. Microwave equipment, automatic exchange battery charging equipment, and trailers. (E.S.B. 14659/60/I.C.A.)\*

**Hillsborough (Co. Down).**—4th July. Electrical installation in new offices for the R.D.C. McCandless & Barton, consulting engineers, 6, Murray Street, Belfast.

**India.**—Director General of Supplies and Disposals, New Delhi. 5th July. Electric tempering furnace. (E.S.B. 14597/60.)\*

Bombay Port Trust, 3rd August. Electrical equipment for secondary substations. (E.S.B. 14524/60.)\*

**London.**—Lewisham Borough Council. 27th June. Street lighting equipment. (See this issue.)

**Merthyr Tydfil.**—Taf Fechan Water Supply Board. Conversion from d.c. to a.c. of electrical installation in the treatment works at Pontsticill. (See this issue.)

**New Zealand.**—G.P.O., Wellington. 13th July. P.v.c. insulated telephone cable. (E.S.B. 14663/60.)\* 20th July. Capacitors. (E.S.B. 14664/60.)\* 28th July. Relays. (E.S.B. 15519/60.)\*

New Zealand Electricity Department, Wellington. 30th August. Galvanised transmission line towers. (E.S.B. 15170/60.)\*

**Saltash.**—Corporation. 26th July. Group "A" street lighting equipment. (See this issue.)

**South Africa.**—Union Tender Board, Pretoria. 27th June. Radio valves. (E.S.B. 14616/60.)\* 15th July. 250 kVA transformer. (E.S.B. 15381/60.)\* 21st July. Switchboard plugs. (E.S.B. 15195/60.)\* 22nd July. Ventilating fans. (E.S.B. 15378/60.)\*

**Southport.**—Corporation. 12th July. Electrical installation in occupational centre, Sandbrook Road, Ainsdale. Town planning officer, 99/105, Lord Street.

**Sudan.**—Department of Posts and Telegraphs, Khartoum. 25th July. Polythene trunk cable. (E.S.B. 14666/60.)\*

Stores Department, Sudan Railways. Lamp bulbs. (E.S.B. 14642/60.)\*

### ORDERS PLACED

**Durham.**—County Education Committee. Electrical installations in schools: Durham Girls' Grammar School (£7,842).—Tanjon (Newcastle). Ferryhill, Hebburn Colliery County School (£201) and Ryhope Modern School (£945).—North of England Engineering & Electrical Co. Newton Aycliffe Campus School (£7,211).—Williams Brothers.

**Sheffield.**—City Housing Committee. Electrical installations in 208 flats within the Brookhill Section of the Netherthorpe redevelopment area (£20,514).—Holliday, Hall & Stinson.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors*

**Ayr.**—Technical college, Dam Park (£682,259); county architect, County Offices, Ayr.

**Bath.**—Erection of second instalment of new technical college; Frederick Gibberd, architect, 19, The Rows, Stone Cross, Harlow, Essex.

Multi-storey car park, Walcot Street; G. C. Mander & Partners, consulting engineers, 5, Berkeley Square, Clifton, Bristol.

**Bedford.**—Six-storey office block, Horne Lane; F. W. Dawkes, architect, Newnham House.

**Birmingham.**—Factory, Bissell High Street; Ephraim Phillips, Ltd., 56, Bissell Street.

**Bracknell.**—Flats (70); Morris de Metz, architect, 29, Gloucester Place, London, W.1.

**Bristol.**—Church and institute, King Street, for Institute for the Deaf; Kenneth Nealon & Partner, architects, 18, Orchard Street.

**Buckingham.**—Erection of Royal Latin School (£147,000); county architect, County Offices, Aylesbury.

**Caterham.**—Central library, Caterham Valley (£43,057); county architect, County Hall, Kingston-on-Thames.

**Chester-le-Street.**—Housing developments, Fatfield; A. & M. Partners, Ltd., builders, Oxclose Road, Washington.

**Doncaster.**—Y.M.C.A. centre, Wood Street (£120,000); H. A. Hickson & Son, architects, Doncaster.

**Durham.**—Houses, shops and hotel at Brancepeth for Dashwood & Partners; Trollope & Son, surveyors, Mount Street, Grosvenor Square, London, W.1.

New premises to replace South Hetton Remand Home (£60,000); county architect, South Street, Durham.

**Eastbourne.**—Factory and offices, Bampton Road; Edwards High Vacuum, Ltd., Crawley, Sussex.

**London.**—Shops and offices, John Princes Street and Great Castle Street, Mayfair; Ardin, Brookes & Partners, architects, 129, Mount Street, W.1.

Additional operating theatre for Royal National Throat, Nose and Ear Hospital, St. Pancras; Watney, Eiloart, Inman & Nunn, architects, The Charterhouse, E.C.1.

Extension to Skinners School, Stamford Hill (£30,000); Campbell Jones & Son, architects, 9, Dowgate Hill, E.C.4.

**Manchester.**—Houses, Marple (240) and Harpurhey (142); director of housing, Town Hall.

**Monmouth.**—Factory for Corrugated Fittings, Ltd.; Johnson & Bailey, Ltd., builders, Norfolk Street, Cambridge.

**Newcastle-on-Tyne.**—Rebuilding newspaper offices, Westgate Road, for Thomson Newspapers, Ltd., Gray's Inn Road, London, W.C.1.

Terminal building at Woolsington Airport (£230,000); P. Parr, city engineer, Town Hall.

Fifteen-storey block of flats, St. Cuthbert's Road, Fenham; city architect.

Shopping centre, Hawes Street, Sycamore Street, and Scotswood Road; city architect, 18, Cloth Market.

**Nottingham.**—Hall of residence, University Park; J. Fletcher Watson, architect, 25, The Close, Norwich.

**Nottinghamshire.**—Ambulance stations at Newark, Retford and West Bridgford; D. E. E. Gibson, county architect, Trent Bridge, Nottingham.

**Nuneaton.**—Divisional police headquarters, Vicarage Street (£124,800); county architect, Shire Hall, Warwick.

**Oxford.**—Office block, St. Michael Street; Hinkins & Frewin, Ltd., Cranham Street.

**Rotherham.**—Council chamber and offices, Moorgate; R.D.C. surveyor, Grove Road.

**Scarborough.**—Extensions to Town Hall buildings (£196,000); V. Forshaw, borough engineer, Town Hall.

**South Shields.**—Extensions for Harton Dyeworks, Ltd. (£120,000); J. Cummings, builder, Matamba Terrace, Sunderland.

**Stanley (Co. Durham).**—Library, High Street; county architect, South Street, Durham.

**Stockton-on-Tees.**—Infants' school, Fairfield; borough architect, 28, The Square.

**Surbiton.**—Houses (29), Middleton estate; borough engineer, Council Offices, Ewell Road.

**Walsall.**—Two training colleges for teachers; M. E. Habershon, borough engineer.

**Warwick.**—Dwellings (34), West End area; Jackson & Edmonds, architects, 116, Colmore Row, Birmingham.

**Wednesbury.**—Houses (50), Winchester Road and Millfields Road; borough surveyor, Town Hall, Holyhead Road.

**Weston-super-Mare.**—Redevelopment of the Oxford Street/Carlton Street area, comprising conference hall, swimming bath, hotel, shopping arcades, etc.; borough engineer, Town Hall.

**Weymouth.**—Houses (115), Chickerell; borough surveyor.

**Whitehaven.**—Main stage of new West Cumberland Hospital; C. B. Pearson & Son, architects, 18, Dalton Square, Lancaster.


**Wilton (Yorks.).**—Recreation club (£86,000); I.C.I. Engineering Department.

**Wolverhampton.**—Works extensions, Hodderness Road; Courtaulds, Ltd., Foleshill Road, Coventry.

**Worthing.**—Fire station and divisional headquarters; county architect, County Hall, Chichester.

\* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.





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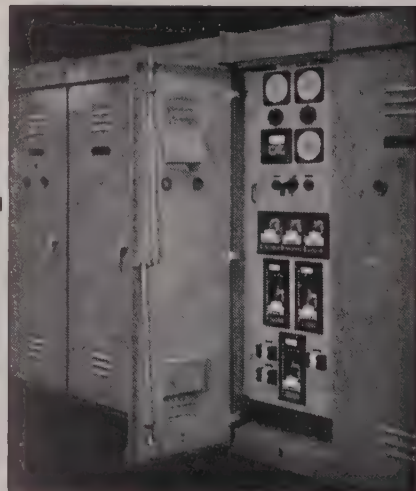
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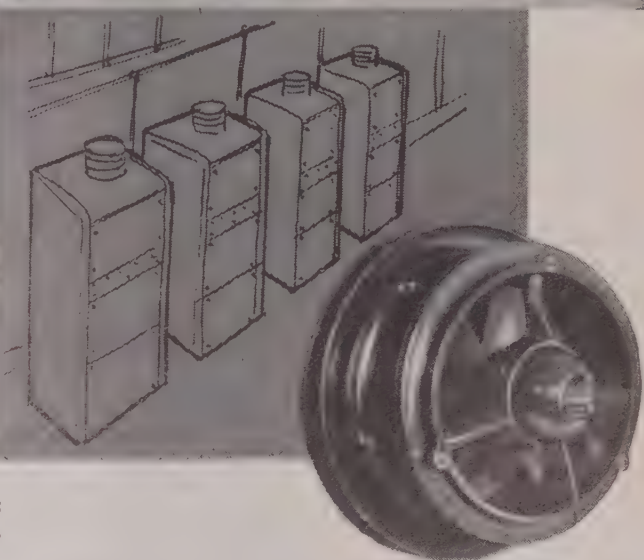
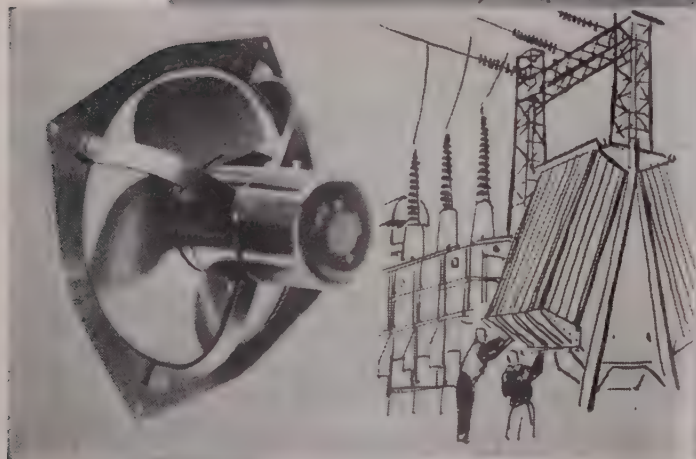
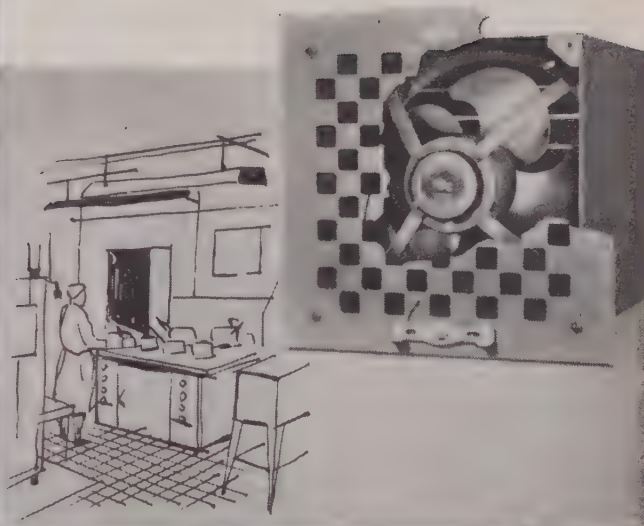
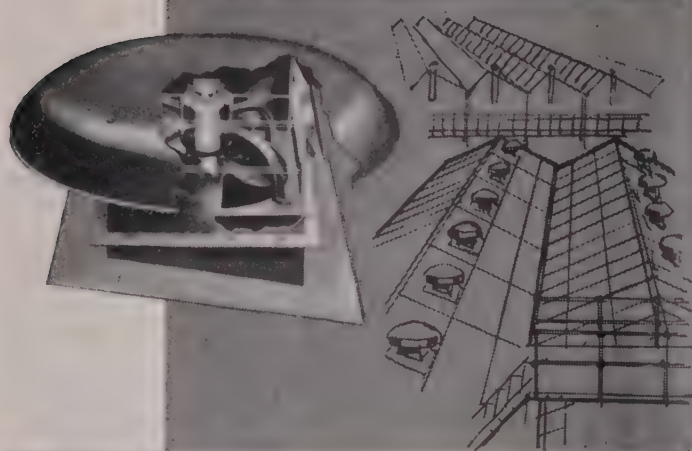


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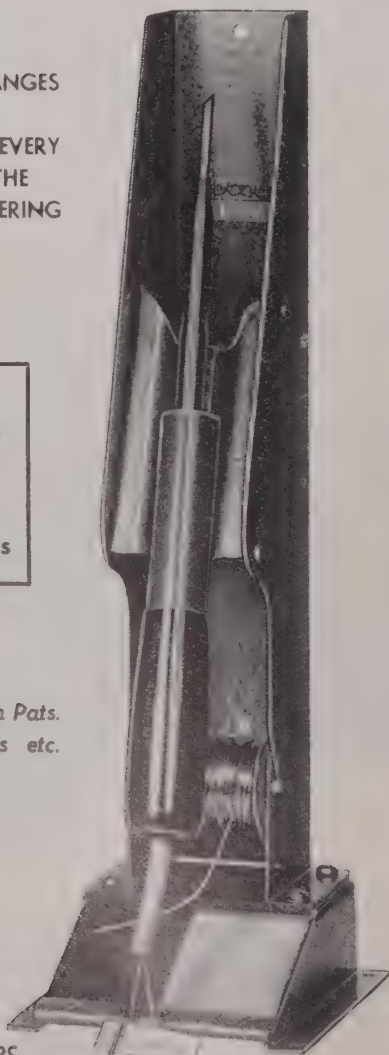
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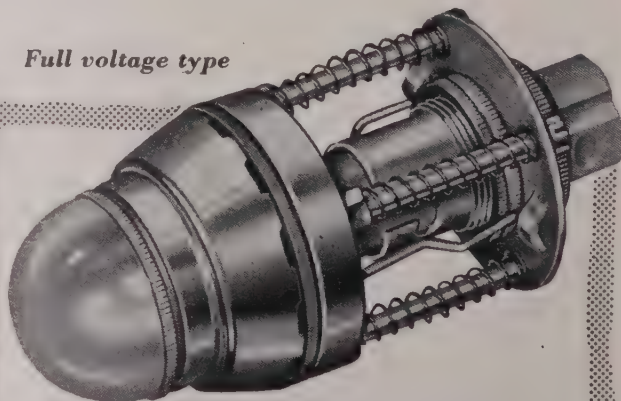
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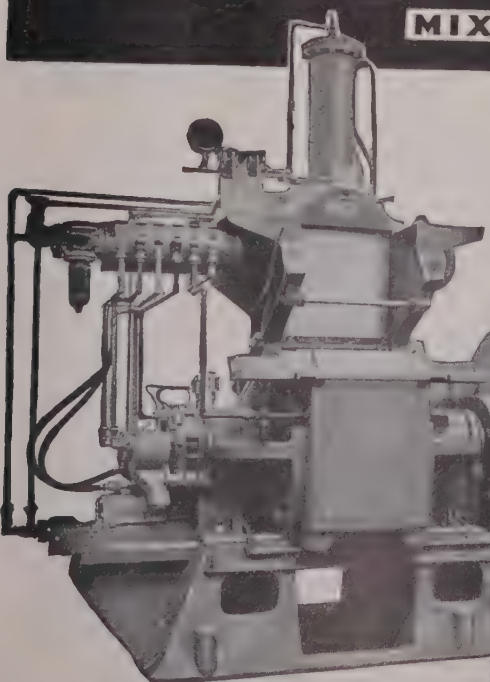
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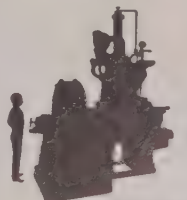
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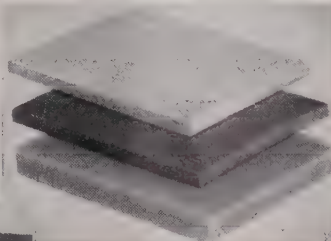
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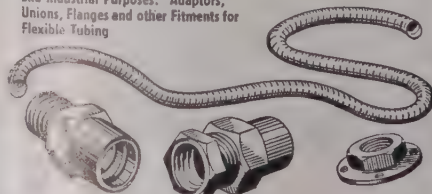


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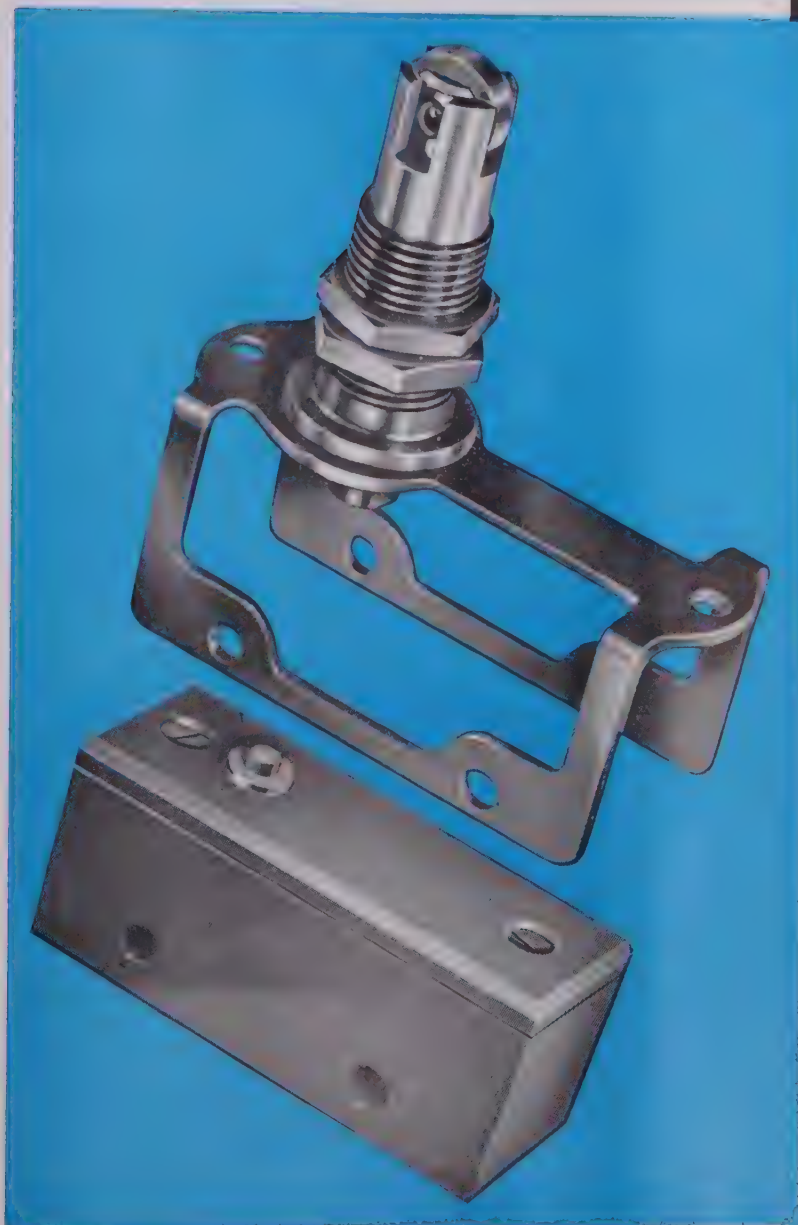
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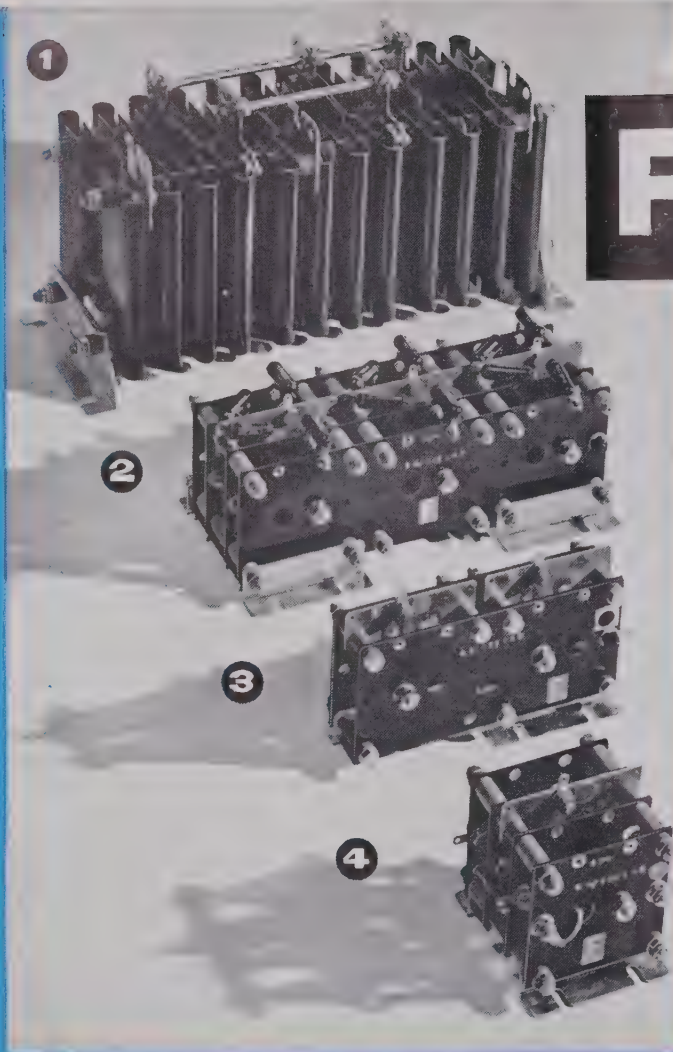

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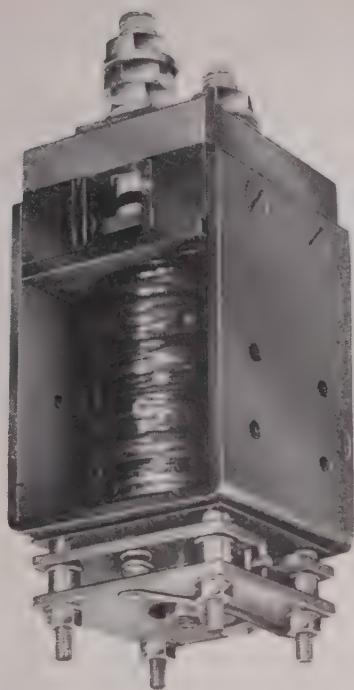


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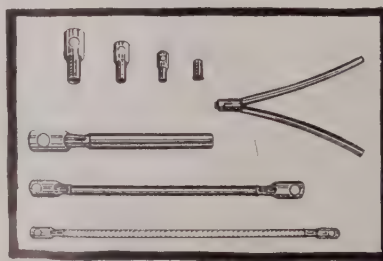
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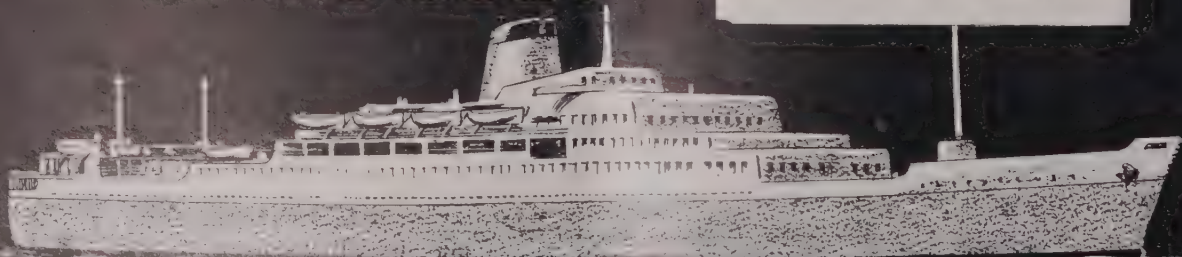
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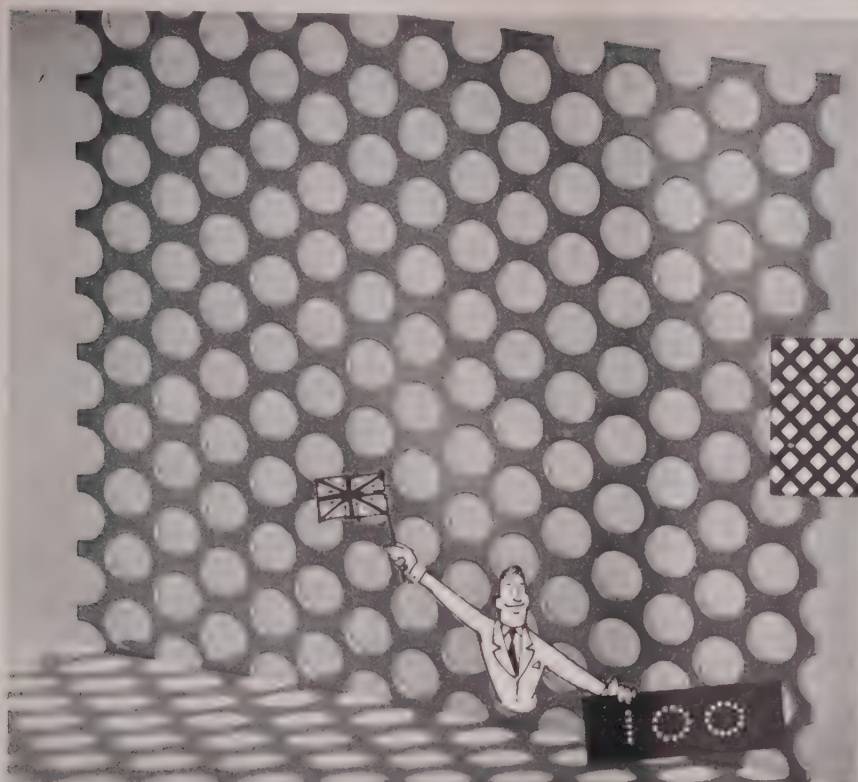


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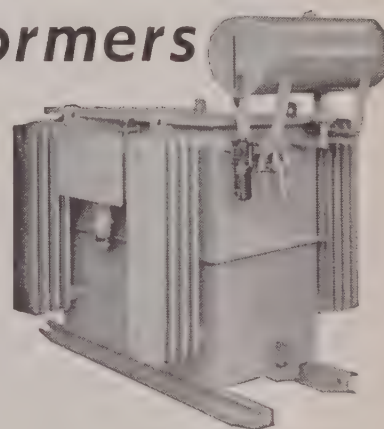


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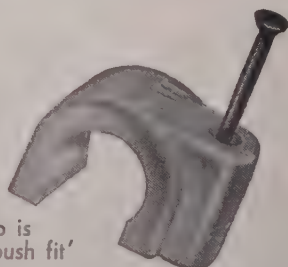
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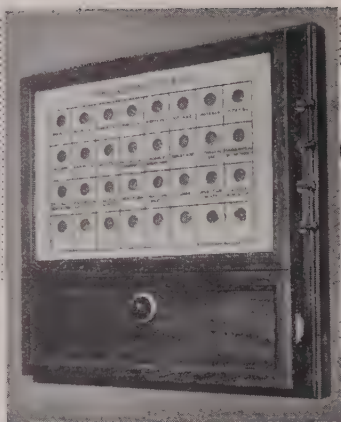
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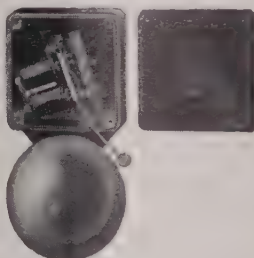
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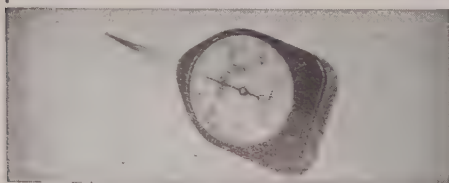
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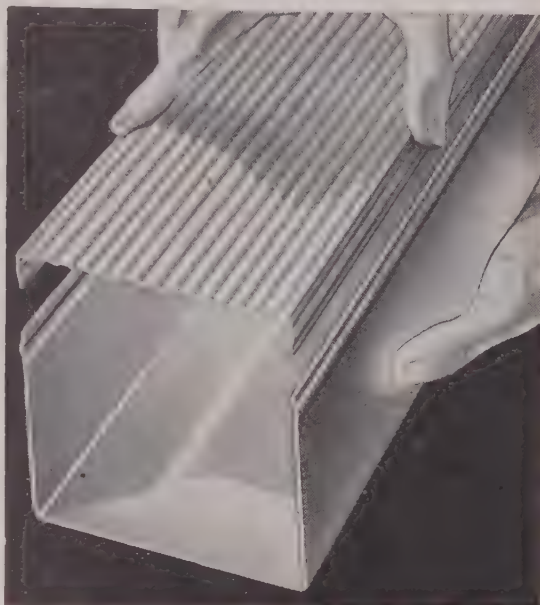
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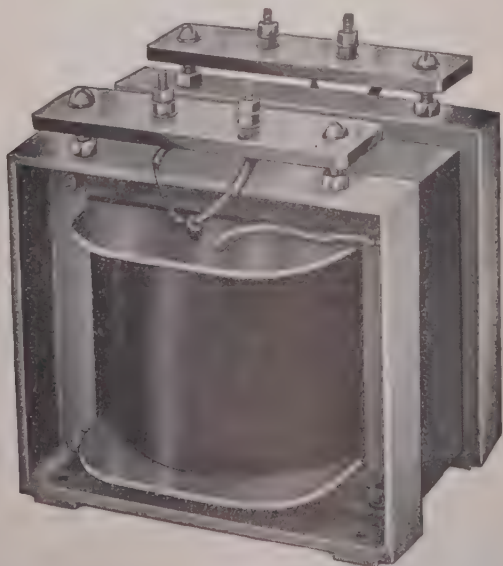
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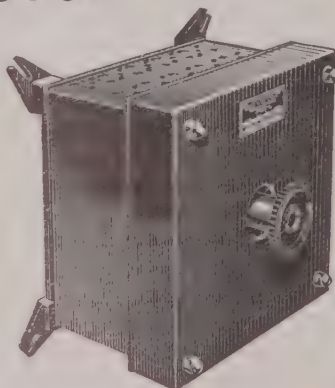
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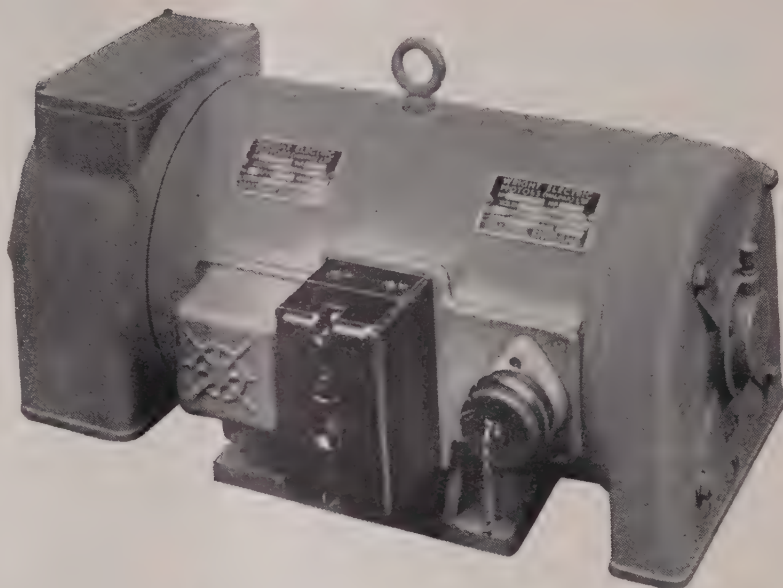
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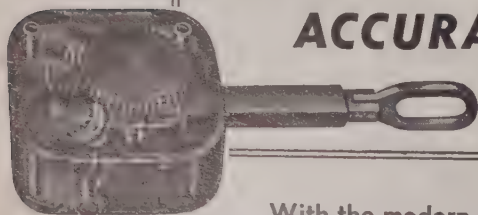
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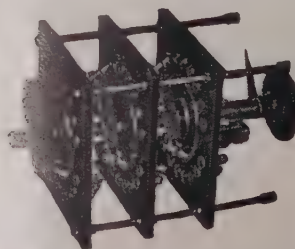
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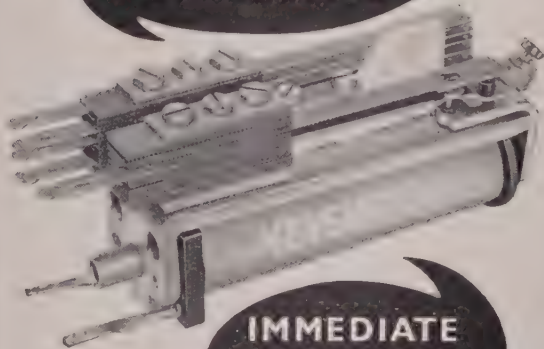
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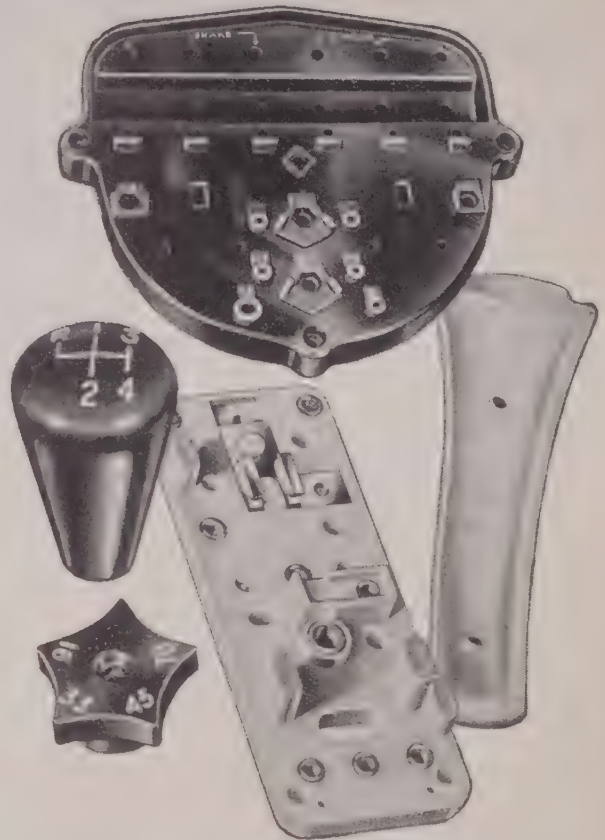
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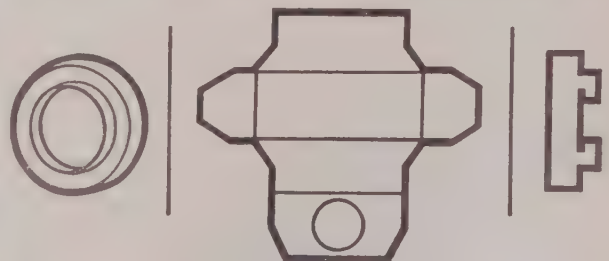
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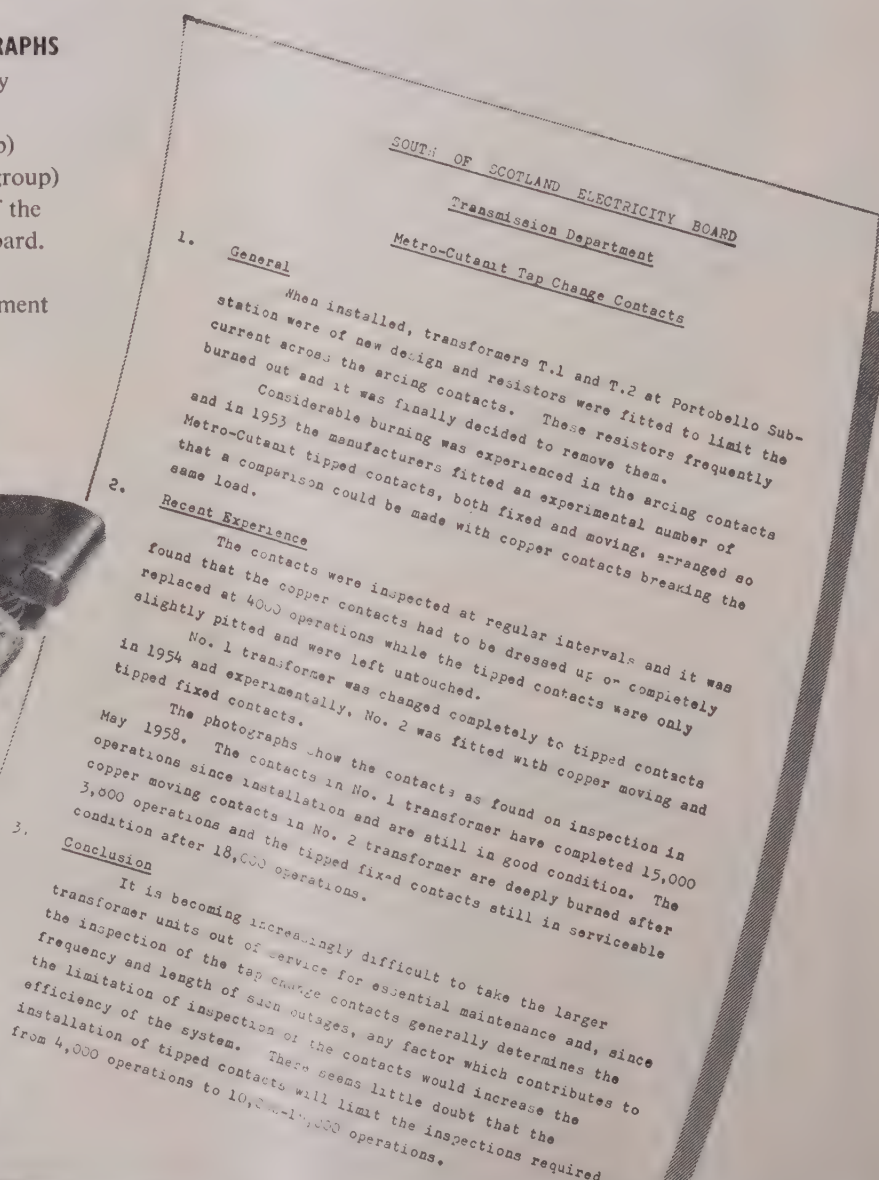
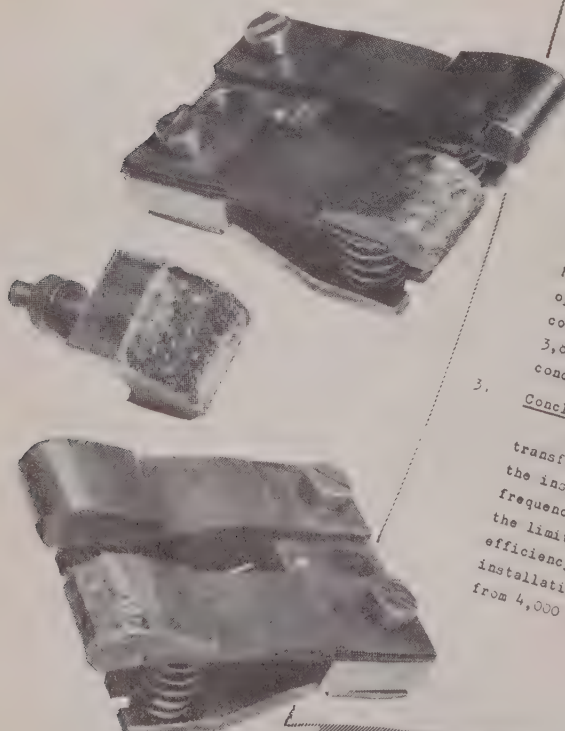


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SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

## OFFICIAL NOTICES, TENDERS, ETC.

### TAF FECHAN WATER SUPPLY BOARD

#### Electrical Conversion from D.C. to A.C.

TENDER documents are being prepared for the conversion, from D.C. to A.C., of the electrical installation in the Treatment Works of the Taf Fechan Water Supply Board at Pontsticill, near Merthyr Tydfil, South Wales.

Firms interested in submitting tenders for specific items of the works listed below are invited to apply to the Board's Consulting Engineers, Messrs. Binnie, Deacon & Gourley, Artillery House, Artillery Row, London, S.W.1, to be considered for inclusion on a list of invited tenderers.

1. Complete overhaul and conversion, from D.C. to A.C., of existing goods lift.
2. Supply only of 2 self-priming water pump sets, complete with motors; capacity 500 g.p.m. against 50-ft. head.
3. Supply only of 2 air compressor sets, with slipping motors; capacity 50 cu. ft. per minute at 100 p.s.i.
4. Supply only of 415-v. T.P. & N. switchboard comprising one 150-amp. circuit breaker, motor starters up to 15 h.p., and sundry switch-fuses.
5. Supply only approximately 250 yards of 3½-core 0.1 sq. ins. P.I.L.C.S.W.A. cable and cable cover tiles.
6. Supply only of several small geared motor units.
7. Supply and installation of one 50-kW water turbine alternator set, complete with switch-board.
8. Supply and installation of all cabling, etc., for the re-wiring of existing equipment and the wiring of new equipment.

Note: Interested firms must be on the Roll of Approved Electrical Installation Contractors. 4894

### AYR COUNTY COUNCIL

#### Ballantrae Street Lighting: Trunk Road A.77

THE County Council will shortly issue separate schedules in connection with the above installation. Schedules will cover:—

1. Supply of concrete standards.
2. Supply of electrical equipment.
3. Work of erection.
4. Supply of lanterns for 140-w. SO/H lamps.

Contractors to indicate to Water and Drainage Engineer, County Buildings, Ayr, in which contracts they are interested.

Any attempt to interlink conditionally the schedules will constitute automatic disqualification.

The County Council is not bound to accept the lowest or any offer. 4838

### BOROUGH OF DAGENHAM

#### Electrical Work: Canvey Island Development, Contract No. 4

TENDERS are invited from approved contractors for the N.I.C.E.I.C. for wiring of electrical lighting and power points in 190 dwellings.

Specifications and forms of tender obtainable from the Borough Engineer and Surveyor.

Tenders, in the official envelopes provided, must be delivered to the undersigned by 2nd July, 1960.

KEITH LAUDER,

Civic Centre, Dagenham. Town Clerk. 4857

### BOROUGH OF SALTASH

#### Street Lighting

TENDERS are invited for the complete installation of Group "A" Fluorescent Lighting in Fore Street and Group "B" Mercury Vapour Lighting in Callington Road, Saltash. A total of 46 lighting units is involved, together with trenching for service cables and other ancillary works.

Conditions of contract, specification and bill of quantities, together with tender form, may be obtained, and drawings seen on application to the Borough Surveyor, Mr. A. de Barr, A.M.I.C.E., M.I.Mun.E., Church House, Saltash.

A deposit of two guineas in the form of a crossed cheque is required, which will be returned on receipt of a bona fide tender. The Council is not bound to accept the lowest or any tender.

Tenders in sealed envelopes which must not bear any indication of the sender, and endorsed "Tender, Street Lighting," to be sent to the undersigned not later than noon on Tuesday, 26th July, 1960.

A. GORDON BELLINGHAM,

Town Clerk.

Church House, Saltash.

10th June, 1960. 4893

### CITY OF BELFAST

#### Lift Installation for Two 13-storey Tower Blocks of Flats at North Queen Street Development Scheme (Victoria Barracks)

THE City Council invite applications from firms wishing to be considered for inclusion on a selected list for the supply and installation of passenger lifts for the two 13-storey Tower Blocks of Flats proposed to be erected at the above.

Manufacturers and Contractors, who have had previous experience of similar installations and wishing to be considered, should make their applications in writing to the undersigned before 12 noon on Thursday, 30th June, 1960. Applicants must submit a list giving particulars of lift installations which they have completed in buildings in which 10 or more storeys are served.

Further information, if required, may be obtained from the Consulting Engineers appointed for the contract, Messrs. McCandless & Barton, 6, Murray Street, Belfast, 1.

JOHN DUNLOP,

Town Clerk.

City Hall, Belfast, 1.

P.O. Box 234.

7th June, 1960. 4868

### DURHAM COUNTY COUNCIL

#### TENDERS INVITED:—

Easington Technical College (Stage 2) and Peterlee County Library: Electrical Installation.

Application for further details to County Architect, South Street, Durham, not later than 22nd June, 1960.

J. K. HOPE,

Clerk of the County Council.

Shire Hall, Durham.

4837

## CLASSIFIED ADVERTISEMENTS ARE PREPAID

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by Friday prior to week of issue

All communications to be addressed to: Classified Advertisement Department, ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1

Original testimonials should not be sent with applications for employment

### COUNTY BOROUGH OF DUDLEY

#### Street Lighting: Third Year Programme

APPLICATIONS to tender are invited for the above contract which provides for an improved lighting installation on various roads within the Borough.

The majority of the work consists of the provision and erection of 705 Group "B" Stanton prestressed concrete columns, 90 Group "B" tubular steel columns and 10 Group "A" lighting points with Mercury and some Sodium lamps, together with all necessary lanterns and control gear.

Applications must be submitted to the Borough Engineer, The Council House, Dudley, Worcs., together with a deposit of £5 5s., which will be returned on receipt of a bona fide tender not subsequently withdrawn and the return of all documents.

The latest date for the receipt of applications is Friday, 24th June, 1960, and tender documents will be forwarded as soon as possible after that date.

P. D. WADSWORTH,

Town Clerk.

Council House,

Dudley, Worcs.

11th June, 1960.

4928

### METROPOLITAN BOROUGH OF LEWISHAM

#### 200-watt Sodium Vapour Street Lighting

TENDERS are invited for the removal of existing mercury vapour equipment and substituting 200-watt linear sodium vapour lighting on approximately 360 existing columns.

Particulars and form of tender obtainable from Borough Engineer, Lewisham Town Hall, Catford, London, S.E.6.

Closing date for receipt of tenders, 10 a.m. Monday, 27th June, 1960. 4895

### SITUATIONS VACANT

See "Replies to Box Numbers" above

### CENTRAL ELECTRICITY GENERATING BOARD

#### Midlands Project Group

#### Third Assistant Engineer (Programmes)

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER (Programmes) in the Midlands Project Group at Bournville. Applicants should preferably possess a Higher National Certificate in either Mechanical or Electrical Engineering and have served a recognised engineering apprenticeship.

The selected candidate will be required to assist in the preparation of detailed programme charts for complete power station projects, including contract procedure, manufacture, site construction and commissioning.

The salary will be within Grade 5 (£1,090-£1,300 per annum) of Schedule C of the National Joint Board Agreement.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham, and should be returned to him not later than 27th June, 1960.

Envelopes should be marked "Confidential Staff Vacancy Notice No. MPG.45/60." 4884



## Situations Vacant (continued)

# Central Electricity Generating Board

## COMMERCIAL DEPARTMENT

### ENGINEERING ASSISTANT

**A**PPPLICATIONS are invited for the post of Engineering Assistant at Headquarters, London, S.E.1.

The duties will include assisting in the investigation of costs and trends in generation and transmission and the preparation of analyses and estimates for tariff purposes.

The post calls for a good general knowledge of thermo-dynamics and the economics of electricity generation and transmission. It is particularly suitable for an engineer having some operational experience in these fields, possessing plenty of initiative and an aptitude for the critical assessment of costs and their commercial implications. Preference will be given to candidates with an engineering degree or a degree in economics with adequate engineering background.

**Salary within the range £1,245 - £1,605 p.a.**

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.1. Envelopes should be marked "Confidential Ref. ER/212."

4858

#### CENTRAL ELECTRICITY GENERATING BOARD

##### North West, Merseyside & North Wales Region

**Padiham "B" Power Station**  
(near Burnley, Lancs)

**E**NGINEERS are required as denoted hereunder for a new 240-MW generating station with unit type boilers operating at 1,500 lb./sq. in. and 1,000° F. re-heat. Applications are required from people receptive to modern ideas but with vision and initiative, of sound engineering experience, and preferably with technical qualifications. N.J.B. terms and conditions of service. Positions superannuable. Duties will eventually cover both "A" and "B" stations.

#### DEPUTY POWER STATION SUPERINTENDENT

(Vacancy No. E.99/273/R).

Salary £1,725/£1,830 (K.2).

#### OPERATION SUPERINTENDENT

(Vacancy No. E.99/274/R).

Salary £1,470/£1,575 (K.4).

#### MAINTENANCE SUPERINTENDENT

(Vacancy No. E.99/275/R).

Salary £1,470/£1,575 (K.4).

#### PLANNING AND DEVELOPMENT ENGINEER

(Vacancy No. E.99/276/R).

Salary £1,360/£1,450 (K.5).

#### FIVE SHIFT CHARGE ENGINEERS.

With experience in the operation of high merit plant (Vacancy No. E.99/278/R).

Salary £1,270/£1,360 plus 10% shift allowance (K.6).

#### ASSISTANT MAINTENANCE ENGINEER (Electrical)

(Vacancy No. E.99/279/R).

Salary £1,195/£1,270 (K.7).

#### FIVE STATION SHIFT CONTROL ENGINEERS

(Vacancy No. E.99/280/R).

Salary £965/£1,025 plus 10% shift allowance (K.10).

Standard application forms are not required but applicants should set out their application in their own preferred form of presentation, giving vacancy number and quoting names of two referees, and forward to the Establishments Officer, Central Electricity House, 825, Wilmslow Road, East Didsbury, Manchester, 20, not later than 20th June, 1960.

4845

#### NORTH EASTERN ELECTRICITY BOARD

**A**PPPLICATIONS are invited for the following appointments:—

**Area Board Headquarters,  
Chief Engineer's Department,  
Construction Section, Carlisle House.**

**FOURTH ASSISTANT ENGINEER** with location at Carlisle House. Applicants should be familiar with substation design and installations, and have experience of checking diagrams of connections for transformers, switchgear and auxiliary equipment, and in the preparation of auxiliary cabling diagrams.

Salary Schedule B, Grade 7 or 8 according to qualifications, £735/£1,040. N.J.B. conditions of service.

**Area Board Headquarters,  
Chief Commercial Officer's Dept.,  
Carlisle House.**

**SENIOR ASSISTANT**, Publicity Sub-Section. The duties will include preparation of displays for use in the Board's service centres, exhibition design, and the design and production of printed material; also work on the decoration and layout of service centres. Applicants must also be able to prepare detail working drawings and visuals for all aspects of point-of-sale publicity, and experience in lecturing on display and publicity would be an advantage. Previous experience in an advertising agency or department is essential.

Commencing salary, according to qualifications, within Grade 6, £980/£1,055, and conditions of service in accordance with N.J.C. Agreement.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carlisle House, Newcastle upon Tyne, within ten days of the appearance of this advertisement.

4872

#### HENDREY RELAYS LIMITED

392, Bath Road, Slough, Bucks

**E**STIMATING AND SALES ENGINEER with experience in the preparation of estimates and tenders for light electro-mechanical instruments and devices required immediately.

Good conditions, five-day week, contributory pension scheme.

Apply in writing giving age, details of training and experience and salary required to the General Manager.

4874

#### THE REPUBLIC OF THE SUDAN

**A**PPPLICATIONS are invited from those suitably qualified to fill a vacancy as **SENIOR ELECTRICAL ENGINEER**, Ministry of Works.

Candidates should be Corporate Members of the Institution of Electrical Engineers, or hold equivalent qualifications. They should have had experience in (a) the design, development and working of alternating current systems, (b) network calculations and application of protective gear, (c) construction and operation of 11-kV power station networks and substations, (d) experience on diesel engine installations and DC/AC change-over will be an advantage.

Appointment will be on contract for a period of three years in the salary range £S.1,866-£S.2,106 (£S.1 equals £1 os. 6d. sterling). A cost-of-living allowance is payable, and an outfit grant of £S.50 is payable on appointment. Home leave accrues at the rate of 7 days per month, with free air passage.

Applications should be made in writing stating age, qualifications and experience to the Appointments Section, Sudan Embassy, 3, Cleveland Row, St. James's, London, S.W.1, quoting reference L.E.7-4/1818.

Closing date 30th June, 1960.

4844

#### ELECTRICAL TECHNICIANS

required by

#### THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

to undertake responsibility for duties in the fields of H.V. and M.V. generating, distribution and maintenance as required. The work may include the operation of a static substation, involving control room duties; maintenance of generating plant and circuit breakers; cable laying, jointing, and the care and testing of protective equipment. Some shift work will be necessary.

Applicants should have served an engineering apprenticeship and have had relevant experience. They should be familiar with the application of rules for safe working and be qualified to act as an authorised person. An O.N.C. in Electrical Engineering or equivalent qualification would be an advantage.

**SALARY** £925 (at age 30 or over) to £1,105 per annum.

Superannuation scheme. Housing, house purchase and hostel facilities.

Write for application form to the Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks.

Please quote reference 2672/48.

4835

#### SENIOR PRODUCTION ENGINEERS

are required by

**W. H. ALLEN SONS & CO. LTD.**

**D**UE to expansion, vacancies exist for additional Senior Production Engineers capable of originating and developing improved manufacturing techniques over a wide range of products on a one-off and small batch basis.

Applicants must have experience in the manufacture of one or more of the following:—

**STEAM TURBINES.**

**DIESEL ENGINES.**

**ELECTRICAL MACHINERY.**

These appointments carry high responsibility and offer good prospects for further advancement. The company offers good conditions of service, a contributory pension and life assurance scheme, and a comprehensive range of welfare and recreational amenities. Assistance towards the expenses involved in moving to the Bedford area will be given to successful applicants where applicable. Salary will be according to qualifications and experience.

Applications, which will be treated in the strictest confidence, should be made in writing, quoting the reference number, to:—

**THE PERSONNEL MANAGER**

(Ref. 1604E/20)

**QUEENS ENGINEERING WORKS  
BEDFORD**

4775



## CENTRAL ELECTRICITY GENERATING BOARD NORTHERN PROJECT GROUP

Applications are invited for the following vacancies, based in the first instance at

### HIGH MARNHAM POWER STATION SITE, NR. NEWARK, NOTTS

Vacancy 60/25/R

#### SENIOR ASSISTANT ENGINEER (ELECTRICAL)

Salary range £1,425 × £50 — £1,775 per annum.

The successful candidate will be responsible to the Board's Resident Engineer for all electrical engineering matters associated with the High Marnham Project. Experience in power station construction and erection and commissioning of electrical plant is essential.

Vacancy 60/26/R

#### THIRD ASSISTANT ENGINEER (ELECTRICAL)

Salary range £1,090 × £30 — £1,300 per annum.

N.J.B. conditions of service. Superannuation Scheme. Membership or qualification leading to membership of an appropriate professional institute will be an advantage.

Application forms available from ADMINISTRATIVE OFFICER, CENTRAL ELECTRICITY GENERATING BOARD, NORTHERN PROJECT GROUP, AGE CROFT ROAD, PENDLEBURY, SWINTON, MANCHESTER, to be returned by not later than 22nd June, 1960. Please quote appropriate vacancy number.

4834

### EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. Applications stating age, qualifications, present position and salary, previous experience and quoting vacancy number should reach the appropriate Manager within fourteen days of the date of this advertisement.

#### Lincolnshire Sub-Area

SERVICE CENTRE SUPERVISOR,  
Lincoln District (Vacancy No. 74/60).

Salary N.J.C. Grade 5, £885 × £25 to £960 per annum.

Candidates should

(a) have had experience in the operation of a busy service centre, supervision of sales staff, planning window displays, sales activity programmes and should be able to advise consumers on tariffs and supply matters in general.

or

(b) have had general experience in a Sub-Area or District Commercial Department of an Area Board, and be keen to broaden their knowledge and experience of the commercial activities of an Area Board.

Applications should be sent to the Manager, Lincoln District, Brayford Side North, Lincoln.

#### Nottingham Sub-Area

SENIOR ASSISTANT (Purchasing)  
(Vacancy No. 56/60).

Salary N.J.C. Grade 5, £885 × £25 to £960 per annum.

The successful applicant will be responsible to the Sub-Area Secretary for all aspects of work in connection with purchasing, records, returns and statistics, including correspondence, of the Sub-Area Purchasing Section.

Applicants should have had experience in purchasing stores and equipment associated with electrical distribution work, service centre sales and office supplies, and should be capable of working on their own initiative.

Applications should be sent to the Manager, Nottingham Sub-Area, 35 39, Carrington Street, Nottingham.

#### Coventry Sub-Area

THIRD ASSISTANT DISTRICT  
ENGINEER (Vacancy No. 76/60).

Salary N.J.B. Class G, Grade 9, £860 × £15 to £905 per annum.

Candidates should have practical experience in the construction, operation and maintenance of underground distribution systems up to and including 11 kV. Ability to drive a motor vehicle is essential, and the successful candidate will be required to reside in Coventry and to undertake standby duties at some future date.

Applications should be sent to the Manager, Coventry Sub-Area, Sandy Lane, Coventry.

4900

### CENTRAL ELECTRICITY GENERATING BOARD

#### East Midlands Division

STATION SHIFT CONTROL ENGINEER,  
DERBY POWER STATION  
(Vacancy No. 143/60).

Applications are invited for the position of Station Shift Control Engineer at Derby Power Station, Full Street, Derby.

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class F, Grade 10 (£765-£810 per annum) of the National Joint Board Agreement, plus £90 per annum allowance for shift duties.

Closing date for receipt of applications, 24th June, 1960.

PLANT SHIFT CONTROL ENGINEER,  
WILLINGTON "A" POWER STATION  
(Vacancy No. 146/60).

Applications are invited for the position of Plant Shift Control Engineer at Willington Power Station, P.O. Box 27, Derby.

Applicants should have had a sound technical training and experience of the operation of a power station, including electrical control room experience.

Preference will be given to candidates who possess technical qualifications to Higher National standard, and experience of pulverised fuel firing will be an advantage.

Salary will be in accordance with Class L, Grade 10 (£1,025-£1,085 p.a.) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 24th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6 ACT, which may be obtained from the Station Superintendent concerned, and should be returned to the Station by the date stated.

O. S. WOODS,  
Divisional Controller.  
4885

### WEST AFRICA: ELECTRICAL APPLIANCE SALESMAN

LARGE merchant company holding important agencies invites applications from men 24/30 years having sales/technical experience in radios, T.V., tape recorders, household appliances. State age, experience. If married, state family. Progressive post, free quarters, paid leaves, pension scheme.—Box 4846.

### SOUTHERN ELECTRICITY BOARD

#### Wayleave Officer

Sub-Area Engineer's Department of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge. Salary N.J.C. Grade 2 (£640-£700 per annum, plus London weighting). N.J.C. conditions of service.

The duties of the post will include the ability to negotiate wayleave agreements for the erection or laying of electric lines and installation of substations and plant.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1210, not later than 27th June, 1960.

#### Service Representative

Ealing District of No. 1 (Southall) Sub-Area. Salary N.J.C. Grade 2 (£640-£700 per annum, plus London weighting). N.J.C. conditions of service.

Applicants should have a general knowledge of application of tariffs and domestic apparatus, together with ability to obtain business and to advise consumers on general matters relating to the supply and use of electricity.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1211, not later than 27th June, 1960.

#### Demonstrator

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. Grade 1 (£525-£625 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus, and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1154, not later than 27th June, 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

4898

### LONDON COUNTY COUNCIL

#### South East London Technical College

LECTURER IN ELECTRICAL ENGINEERING required as soon as possible. Salary within the scale £1,408 × £35 to £1,601, according to age and experience.

Application forms from College Secretary FE3a ER 1599 6', South East London Technical College, London, S.E.4, returnable within two weeks.

4906



## Situations Vacant (continued)



## SOUTH WESTERN ELECTRICITY BOARD

Vacancies for :

- (1) Third Assistant District Engineer (Planning), Bristol
- (2) Senior Draughtsman, Weston District
- (3) Third Assistant District Engineer (Planning), Taunton
- (4) Third Assistant District Engineer (Supply), Taunton
- (5) Branch Manager, Honiton, Exeter District
- (6) Third Assistant District Engineer (Construction), Exeter
- (7) Fourth Assistant District Engineer (O.&M.), Exeter
- (8) Wayleave Assistant, Plymouth District
- (9) Third Assistant District Engineer (Planning), Plymouth

Closing Date for Receipt of Completed Applications is Monday, 4th July, 1960

### 1. THIRD ASSISTANT DISTRICT ENGINEER (Planning), BRISTOL.

Salary within Class K, Grade 9 (£1,025 × £20 to £1,085 per annum) of the N.J.B. Agreement.

The successful candidate will be required to assist the District Planning Engineer in the design of E.H.V., H.V. and M.V. systems, fault level and load flow investigations; loading estimates and negotiations with local authorities and architects.

Possession of the Higher National Certificate in Electrical Engineering is essential and the ability to drive a car would be an advantage.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the Group Administrative Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1.

### 2. SENIOR DRAUGHTSMAN, WESTON DISTRICT.

Salary within Grade 4 (£930 × £20 to £1,030 per annum) of Schedule D of the N.J.B. Agreement.

Applicants should be experienced engineering draughtsmen and surveyors, and be capable of supervising a drawing office which includes surveying and field records staff. Experience in all classes of drawing work in connection with electricity supply is essential, and previous experience in the supervision of staff would be an advantage.

Possession of an Ordinary or Higher National Certificate (Electrical or Building) and a current driving licence are desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, 168, Locking Road, Weston-super-Mare.

### 3. THIRD ASSISTANT DISTRICT ENGINEER (Planning), TAUNTON.

Salary within Class G, Grade 9 (£860 × £15 to £905 per annum) of the N.J.B. Agreement.

The successful candidate will be required to assist generally in the District Engineering Department and in planning research and the technical work of a large distribution system on voltages up to and including 33 kV. Duties will include the examination of system loads, preparation of capital applications for reinforcement and new development schemes, system calculations and load forecasting, and work in connection with the preparation of the capital budget.

Applicants should have a broad technical training and experience of construction and operation of systems up to and including 33 kV and may be required to undertake standby duties. Possession of the Higher National Certificate in Electrical Engineering or its equivalent will be an advantage.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, The Parade, Taunton.

### 4. THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (Supply), TAUNTON.

Salary within Class G, Grade 9 (£860 × £15 to £905 per annum) of the N.J.B. Agreement.

The successful applicant will be required to give general assistance in the District Commercial Office and duties will include the preparation of rural development programmes; assistance with the negotiations of supplies to housing estates, industrial and large commercial consumers; negotiations of street lighting agreements and assistance to branches in administrative work connected with these agreements; development of contracting services throughout the Districts, including assistance to branches with the preparation of specialised tenders.

Possession of appropriate qualifications at least equal to the Higher National Certificate in Electrical Engineering will be an advantage.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, The Parade, Taunton, Somerset.

### 5. BRANCH MANAGER, HONITON, EXETER DISTRICT.

Salary within Class G, Grade 7 (£965 × £20 to £1,025 per annum) of the N.J.B. Agreement.

The candidate appointed will be responsible to the District Manager, Exeter, for the efficient operation of the branch. Duties include commercial development, consumer service, sales and electrical installation contracting in the branch area, operation and maintenance of the distribution system, and such constructional work as may be delegated. The successful applicant will be required to undertake standby duties.

Technical qualifications equivalent to the Higher National Certificate in Electrical Engineering, an all-round commercial and engineering experience, and the ability to control staff will be an advantage. The possession of a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, 3, Bedford Street, Exeter, Devon.

### 6. THIRD ASSISTANT DISTRICT ENGINEER (Construction), EXETER.

Salary within Class G, Grade 9 (£860 × £15 to £905 per annum) of the N.J.B. Agreement.

The successful candidate will be responsible to the Second Assistant District Engineer (Construction) for all types of construction work, including H.V. and L.V. o/h lines and u/g cables, the preparation of material schedules, the phasing of work and supply of materials, the efficient supervision of works during construction, utilising labour and mechanical aids to the best advantage, keeping a check on costs, preparing reports and statistics, and for the maintenance of progress records. He will be required to carry out standby duty.

Applicants should have had experience in the construction and operation of distribution mains and equipment, and should possess a Higher National Certificate in Electrical Engineering or qualifications leading to it. The ability to drive a car and the possession of a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, 3, Bedford Street, Exeter.

### 7. FOURTH ASSISTANT DISTRICT ENGINEER (Operation and Maintenance), EXETER.

Salary within Class G, Grade 11 (£765 × £15 to £810 per annum) of the N.J.B. Agreement.

The successful candidate will be required to undertake general duties on the maintenance of the E.H.V., H.V. and L.V. networks and may be required to carry out standby duties.

Applicants should have had some experience in the operation and maintenance of u/g and o/h distribution systems, and possession of the Higher National Certificate in Electrical Engineering would be an advantage. The ability to drive a car and the possession of a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, 3, Bedford Street, Exeter.

### 8. WAYLEAVE ASSISTANT, PLYMOUTH DISTRICT

Salary within Grade 2 (£640 × £20 to £700

per annum) of the N.J.C. Agreement.

The duties of the successful candidate will include the acquisition of wayleaves and substation sites and negotiation of claims for damage arising therefrom under the supervision of the District Wayleave Officer; also the maintenance of wayleave records as required by Board procedure.

Previous experience in a similar position, or one involving knowledge of land and agricultural values, and a knowledge of draughtsmanship and of the erection of overhead lines will be an advantage. Possession of a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, Elliott Road, Prince Rock, Plymouth.

### 9. THIRD ASSISTANT DISTRICT ENGINEER (Planning), PLYMOUTH.

Salary within Class G, Grade 9 (£860 × £15 to £905 per annum) of the N.J.B. Agreement.

The successful candidate will be required to assist generally in the planning and technical work relating to construction of substation equipment up to and including 33 kV, and also for both overhead and underground systems. The person appointed may be required to undertake standby duty and he will be a Senior Authorised Person.

Possession of appropriate technical qualifications at least equivalent to the Higher National Certificate in Electrical Engineering is necessary and a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, obtainable by postcard only from the District Manager, South Western Electricity Board, Elliott Road, Prince Rock, Plymouth.

4905

## NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

### Dundee Area

**A**PPPLICATIONS are invited for the under-mentioned appointments:—

### SECOND ASSISTANT ENGINEER (Operation and Maintenance).

Applicants should have had a sound technical education and have obtained a Higher National Certificate or Engineering Degree. Preference will be given to Corporate Members of the Institution of Electrical Engineers.

Duties will include load flow and short circuit calculations, the control of system switching operations, and the co-ordination of district work to obtain standard methods of construction and maintenance. Previous operational experience in city and rural districts is essential.

Salary will be in accordance with National Joint Board Agreement Schedule A, Class H, Grade 6, £1,095 to £1,170.

### SECOND ASSISTANT ENGINEER (Planning).

Educational qualifications should be as for the above-mentioned position.

Applicants should be well experienced in city and rural transmission and distribution planning up to 33 kV. The successful candidate will be required to assess load development and deal with forward planning for distribution.

Duties will include planning of H.V. and L.V. reinforcements, distribution to new high density housing and city redevelopment works, also design of indoor and outdoor substations up to 33 kV.

Salary will be in accordance with National Joint Board Agreement Schedule A, Class H, Grade 7, £1,025 to £1,085.

### CLERICAL ASSISTANT (Progress and Contracts).

Applicants should be well educated and have had considerable experience in office procedure and methods.

The successful applicant will be employed in the Area Engineer's Department to prepare contract documents and tenders, and to allocate and record plant transfers. Duties will include programming of construction works and the maintenance of records for progress control.

Salary will be in accordance with National Joint Council Agreement, Grade 1 or 2, £525 to £625 or £640 to £700, according to qualifications and experience.

Applications should be on the standard application form obtainable from the Area Manager, 7, Dudhope Crescent Road, Dundee, and should be returned by the 2nd of July, 1960.

4902





## M.K. ELECTRIC LIMITED

have the following vacancies in their Technical Drawing Office.

**DESIGNERS**—experienced in the design of small Electrical/Mechanical products for large-quantity manufacture.

**DRAUGHTSMEN**—with routine Drawing Office experience and preferably in connection with small Electrical products—preparing standard drawings, data sheets, etc.

**PHOTO-PRINTING**—an assistant (male or female) for the photo-printing and photographic section with previous photo-printing experience and a knowledge of industrial photography.

Excellent working conditions in a new Drawing Office. Five-day week of 37½ hours. Holiday arrangements honoured and attractive salaries offered according to experience.

Applications treated in strict confidence if addressed to:—

Technical Manager

### M.K. ELECTRIC LIMITED

Shrubbery Road, Edmonton, London, N.9

4841

#### CENTRAL ELECTRICITY GENERATING BOARD

##### South Western Division

**SENIOR DRAUGHTSMAN (ELECTRICAL)** required in the Electrical Department at Divisional Headquarters, Bristol.

Superannuation scheme. Salary, N.J.B. Schedule D, Grade 4, £930-£1,030 or Grade 5, £790-£890 per annum, according to qualifications and experience.

The successful candidate will be required principally to prepare electrical layout drawings for outdoor grid substations but general adaptability is considered important. Technical education to H.N.C. is desirable. Quote vacancy ER/AV/78/60. Closing date 25th June, 1960.

Previous applicants will be reconsidered.

**FOURTH ASSISTANT ENGINEER** required in the Taunton District of the Electrical Department.

Superannuation scheme. Salary, N.J.B. Class AX/DX, Grade 7, £840-£965/£1,040 per annum.

Duties in the first instance will be the supervision of overhead line construction up to 275 kV and later substation erection. Subsequently the duties will include commissioning and maintenance.

Candidates should hold qualifications leading to Corporate Membership of one of the major Engineering Institutions. Quote vacancy ER/AV/77/60. Closing date 23rd June, 1960.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by the date stated. 4907

#### PATENT EXAMINERS AND PATENT OFFICERS

**PENSIONABLE** posts for men or women for work on the examination of Patent examinations. Age at least 21 and under 29 (36 for Examiners), with extension for Regular Forces service and overseas Civil Service.

Qualifications: normally first or second class honours degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C.

London salary (men) £655-£1,460; provision for starting pay above minimum. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting S/128/60, and stating date of birth. 4880

#### SOUTH OF SCOTLAND ELECTRICITY BOARD

##### Lanarkshire Area

**Second Assistant District Commercial Engineer, Coatbridge District**

**APPLICATIONS** are invited for the above appointment. Applicants should have had a sound engineering and technical training and subsequent experience in the development of industrial load and of off-peak supplies to all classes of consumers. They will also be required to assist in the general work of the Commercial Department.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, the present classification and grading being H.7, salary £1,025/£1,085 per annum. The post is superannuable.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,

Montrose Crescent,  
Hamilton.

Manager.  
4839

#### AIR MINISTRY

**STATION ENGINEERS (G.D.)** and **STATION ENGINEERS (Mech.)** required at R.A.F. and Ministry of Aviation Stations. The work of Station Engineers (G.D.) consists of installation, operation and maintenance of high and medium-voltage electrical distribution systems, electrical power and lighting installations, control systems and generating plant; knowledge of heating and ventilating plant and diesel engines an advantage. Station Engineers (Mech.) are concerned with diesel power plant, steam and hot water heating systems, refrigeration and air conditioning and miscellaneous workshop plant, tools and equipment.

Candidates must hold O.N.C. Elec. or Mech./City and Guilds Electrical Technicians Certificates/2nd Class M.O.T. Certificate or equivalent, and must also have had recognised apprenticeship with firm of good repute plus 3 years' employment in electrical or mechanical engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference to candidate with supervisory experience.

Salary ranges from £680 to £785 rising by annual increments to £850. Commencing salary dependent upon age, qualifications and experience.

Opportunities for promotion up to Tech. Grade A, maximum salary £1,565 (national rate). Pension prospects. 5-day week. 18 days' paid leave a year initially. Internal training courses are provided and attendance at technical colleges by suitable candidates is sponsored. Overseas tours for which special allowances are payable in addition to higher salary.

Applicants, who must be natural-born British subjects, up to age 35, should write stating age, qualifications and experience to Manager (P.E.1), Ministry of Labour, P. & E. Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Only applicants selected for interview will be advised. 266

#### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

**ASSISTANT CONSUMERS' ENGINEER** required at Blaenau Ffestiniog. Salary within range £655/£700 per annum (N.J.B. E/11).

Applicants should have completed a recognised electrical apprenticeship and had some technical training. Duties will include estimating, preparation of specifications and supervision of contracting work, advising consumers on matters relating to electricity supply and the utilisation of electricity. The ability to speak Welsh and to drive would be an advantage.

The work is of an interesting nature, and the post is pensionable, with good working conditions and reasonable future prospects to suitable staff.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhosyllen, Nr. Wrexham.

Closing date, 27th June, 1960.

4897

## PROFESSIONAL ELECTRICAL ENGINEER

is required at

### ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

to **DESIGN, DEVELOP and COMMISSION** a THERMONUCLEAR EXPERIMENT in a team as first or second assistant.

Work is primarily electrical, involving:—

- \* HIGH MAGNETIC FIELDS.
- \* ELECTRICAL STRESS PROBLEMS.
- \* ENERGY STORES and HIGH-VOLTAGE SUPPLIES.

Also:—

HIGH-VACUUM TECHNOLOGY, HEAT TRANSFER and MATERIALS and EQUIPMENT SELECTION.

The fundamental nature of the work makes the background of an Engineering Honours Degree and relevant postgraduate experience desirable.

**SALARY** £1,370-£1,825 p.a. or £860 (at age 25) to £1,340 p.a. according to age and experience.

Housing and contributory pension schemes.

Send **POSTCARD** for details to the Personnel Manager (1687/48), U.K.A.E.A., A.E.R.E., HARWELL, DIDCOT, BERKS.

4836



**Situations Vacant (continued)****CENTRAL ELECTRICITY  
GENERATING BOARD****East Midlands Division**

**A**PPPLICATIONS are invited for the following positions at Willington Power Station, P.O. Box 27, Derby.

**ASSISTANT ENGINEER**  
(Electrical Maintenance),  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 147/60).

Applicants should have received a sound technical training and have had practical experience in the maintenance of power station electrical plant.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 9 (£1,195 - £1,270 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT ENGINEER (Instruments),**  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 148/60).

Candidates should have had a sound technical training and have a good practical knowledge of the construction, repair and testing of power station instruments and automatic controls. Knowledge of electronic and other modern forms of instrumentation and controls will be an advantage.

Salary will be in accordance with Class M, Grade 10 (£1,095 - £1,170 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT ENGINEER (Coal and Ash),**  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 149/60).

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

Experience of dust disposal by pipeline would be an advantage, and the duties of the successful candidate will include the organisation of ash disposal by lorry transport.

Salary will be in accordance with Class M, Grade 11 (£1,025 - £1,085 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT ENGINEERS**  
(Planning and Efficiency),  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 150/60).

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates with Higher National or Degree qualifications in Electrical and/or Mechanical Engineering. Applicants should state their preference for Planning Section or Efficiency Section.

Salary will be in accordance with Class M, Grade 8 (£1,270 - £1,360 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**SECOND ASSISTANT**  
**STATION CHEMIST,**  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 151/60).

It is desirable that applicants have a University Degree or Associateship of the Royal Institute of Chemistry and experience in general chemical analysis, with particular experience in the use of physico-chemical apparatus such as U.V. Spectrophotometer, and a knowledge of statistical methods.

Salary will be in accordance with Class M, Grade 11 (£1,025 - £1,085 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**SHIFT CHARGE ENGINEERS,**

**WILLINGTON "B" POWER STATION**  
(Vacancy No. 152/60).

Candidates should have had a sound technical training and considerable experience in a modern power station. Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications, and a knowledge of pulverised fuel firing will be an advantage.

Salary will be in accordance with Class K, Grade 6 (£1,270 - £1,360 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT SHIFT CHARGE**  
**ENGINEERS,**

**WILLINGTON "B" POWER STATION**  
(Vacancy No. 153/60).

Applicants should have received a sound technical training and have had experience in a modern power station. Preference will be given to candidates who possess the Higher National Certificate, or its equivalent.

Salary will be in accordance with Class K, Grade 8 (£1,095 - £1,170 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT ENGINEER**  
(Mechanical Maintenance),  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 154/60).

Applicants should have had considerable experience in the mechanical maintenance of

large modern power stations. Technical qualifications to Higher National Certificate standard in Mechanical Engineering or equivalent.

Salary will be in accordance with Class M, Grade 8 (£1,270 - £1,360 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

**ASSISTANT ENGINEER**  
(Mechanical R. and M.),  
**WILLINGTON "A" AND "B"**  
**POWER STATION**  
(Vacancy No. 155/60).

Applicants should have received a sound technical training and have had wide practical experience in the maintenance of power station mechanical plant.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 6 (£1,470 - £1,575 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned, and should be returned to the station by the date stated.

O. S. WOODS,  
Divisional Controller.  
4886

## ELECTRO MECHANICAL DESIGN ENGINEER

Applications are invited from qualified electro-mechanical engineers over 30, who have the initiative and drive to lead a development group engaged in the design of electro-magnetic devices and mountings similar to those applied in modern telecommunications switching systems.

Candidates should have at least 5 years' experience in this class of design work for mass production and competitive consumer markets.

A knowledge of switching systems functions is also desirable.

Qualifications required are an engineering degree or H.N.C. (mechanical) and corporate membership of a recognised institute.

Our Company is well established in the London area, and offers a permanent career with a good pension scheme and progressive conditions of employment.

A brief outline of qualifications and experience should, in the first instance, be sent in confidence to Box 4877.

**NORTH WESTERN ELECTRICITY BOARD**

**Third Assistant Engineer (Design), Sub-Area**  
**Engineering Department, Bolton**

**T**HE duties will include assisting in the design of H.V. and L.V. networks and programming and progressing constructional work.

Experience in calculations of system load flows, fault levels and relay settings is desirable, and applicants should have had a sound training in electrical engineering to degree or H.N.C. standard.

Salary scale £1,025 x £20 to £1,085 p.a., Grade L.10. N.J.B. conditions.

Applications on a form to be obtained from the Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, and returned to him by 29th June, 1960.

4871

**MERSEYSIDE AND NORTH WALES  
ELECTRICITY BOARD**

**F**OURTH ASSISTANT ENGINEER (Planning) required at No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire. Salary within range £815/£860 per annum (N.J.B. K/13).

Applicants should preferably possess the Higher National Certificate or equivalent qualifications in electrical engineering, and should have had some experience in overhead and underground distribution work.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date 27th June, 1960.

4896



## BRITISH OXYGEN GASES LIMITED

# ELECTRICAL ENGINEER

An Electrical Engineer between 25 and 30 years of age is required for interesting development work in connection with power units and control gear for inert gas welding. A knowledge of electronics is an advantage, and the candidate should possess a Degree or H.N.C. in Electrical Engineering.

## TECHNICAL ASSISTANTS

Technical Assistants are also required in the age range 25-30. They should have an electrical background and H.N.C. in Electrical Engineering would be preferred. Candidates should have a knowledge of electronics or development experience in industry.

There are good future prospects and very good commencing salaries are offered.

Housing assistance is available if required.

Please reply stating full particulars to the:—

**PERSONNEL MANAGER**  
SPENCER HOUSE, ST. JAMES'S PLACE  
LONDON, S.W.1

4833

### YORKSHIRE ELECTRICITY BOARD

#### No. 4 (Leeds) Sub-Area SENIOR ASSISTANT ENGINEER (Meters Testing and Protection).

Applications are invited from Corporate Members of the Institution of Electrical Engineers for the above vacancy. Ability is required to organise, conduct and supervise the work of the section which includes metering, protection, fault location, communications and supervisory control.

Salary N.J.B. Class L, Grade 4, £1,600/£35/£1,705 per annum.  
DEMONSTRATOR (Female).

Candidates should have completed a two-year full-time course in domestic subjects at a recognised training college and should preferably possess the Certificate of the Electrical Association for Women.

Previous experience of demonstrating, particularly within the electricity supply industry, will be an advantage.

Salary N.J.C. Grade 1, £525/£20/£625 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Nr. Leeds, not later than 1st July, 1960.

#### Head Office THIRD ASSISTANT ENGINEERS, DISTRIBUTION DESIGN (Substations).

The successful applicants will be required to assist with the design of indoor and outdoor substations operating at voltages of 33 kV and above, the preparation of specifications for substation plant, negotiations with plant manufacturers, and inspection of equipment in course of manufacture.

The minimum technical qualifications are the possession of a good Higher National Certificate in Electrical Engineering and Graduate Membership of the Institution of Electrical Engineers.

Applicants should have had a few years' general experience of field construction work and should preferably have some practical knowledge of the construction and erection of substation plant.

The work offers scope for the development of technical knowledge and experience, particularly in respect of switchgear, transformers and protection gear.

Salary N.J.B. Schedule B, Class AX-EX, Grade 6, £925/£25/£1,050 rising to £1,170 per annum.

Applications, giving full details of age, qualifications and experience, together with the names

of two referees, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than 1st July, 1960.

#### No. 7 (Grimsby) Sub-Area SCUNTHORPE DISTRICT THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should be of Higher National Certificate standard in Electrical Engineering and have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class G, Grade 9, £860/£15/£905.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 1st July, 1960.

#### No. 1 (Bradford) Sub-Area OTLEY DISTRICT THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should have passed the Associate Membership Examination of the Institution of Electrical Engineers, or hold equivalent qualifications, and have experience in construction, operation and maintenance of high voltage systems, underground cable, overhead lines, substations, and medium low voltage networks.

Candidates should be prepared to reside within the district and undertake standby duties.  
Salary N.J.B. Class F, Grade 9, £815/£15/£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53, Sunbridge Road, Bradford, not later than 1st July, 1960. 4899

### AIR MINISTRY

**ASSISTANT MECHANICAL and ELECTRICAL ENGINEERS** required for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports.

Salary £805 at 25 to £1,095 at 34 or over, thereafter rising to maximum £1,260, with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. 5-day week with 4 weeks 2 days leave a year initially. Special allowance in addition to salary during overseas service.

Qualifications and experience:—

- (i) (a) University Degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or
- (b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or
- (c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience with at least 3 years' apprenticeship; and
- (ii) Have been employed for minimum of 2 years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural-born British subjects between ages of 25 and 45.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.158/OA. 257

### COUNTY BOROUGH OF BURTON UPON TRENT EDUCATION COMMITTEE

#### Technical College

Principal: E. White, M.Sc.(Econ.)

**REQUIRED** in September, 1960, or as soon as possible after that date, **LECTURER IN ELECTRICAL ENGINEERING** to take some or all of the following subjects to H.N.C. level: Electronics, Electrotechnology, Distribution and Utilisation. Candidates should have graduate qualifications and good teaching and industrial experience.

Salary will be in accordance with the Burnham Technical Scale. Forms of application, which may be obtained from the undersigned upon receipt of a stamped, addressed foolscap envelope, should be sent as soon as possible to the Principal, The Technical College, Burton upon Trent.

A. H. BLAKE,

Education Office, Guild Street,  
Burton upon Trent. 4901

### COUNTY OF LANARK

**CHIEF TECHNICAL ASSISTANT** required for County Lighting Department at Hamilton with experience in design, erection and maintenance of public lighting installations. Applicants must be either Corporate Members of Institution of Electrical Engineers or hold final examination certificate of City and Guilds in Illuminating Engineering. Salary scale £795/£1,075 with placing according to qualifications and experience.

Superannuation. Medical examination. No canvassing.

Application form from County Clerk, P.O. Box No. 1, Glasgow, and should be returned by 22nd June, 1960. 4915

## SENIOR PRODUCT ENGINEER

### RANCO LIMITED, TANNOCHSIDE, GLASGOW

**A VACANCY** exists in a light engineering factory for an **ELECTRICAL ENGINEER** of degree or similar status. Applicants should have experience in electric motor manufacture; fractional horse-power experience an advantage. The appointment is a new one and the position offers scope to persons of initiative.

Pension and life assurance schemes in operation.

Applications to the Personnel Manager, quoting ref. number 0/2/3. 4870



**Situations Vacant (continued)****EASTERN ELECTRICITY BOARD**

**A**PPPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

**Chilterns Sub-Area**

**SUB-AREA HEADQUARTERS, BEDFORD**  
**SECOND ASSISTANT ENGINEER**  
(Planning and Development) (145/60.R).

Candidates should have had a wide experience in the design, layout and operation of urban and rural distribution systems comprising overhead and underground networks (including substations) at voltages up to and including 33 kV. They should be experienced in the preparation of distribution schemes including the technical design, specification and estimates. Corporate Membership of the Institution of Electrical Engineers or the possession of a degree in electrical engineering will be an advantage.

Salary N.J.B. Class L, Grade 7 (£1,270-£1,360).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford, by 1st July, 1960.

**Northmet Sub-Area**

**SUB-AREA HEADQUARTERS,**  
**LONDON, N.14**  
**FOURTH ASSISTANT ENGINEER**  
(Operation and Maintenance) (Ref. 978)  
(147/60.R).

The duties include the commissioning and testing of system protection, automatic control and communications equipment. Whilst some previous experience is desirable candidates who lack this experience but have a good technical background will be considered.

Salary N.J.B. Grade 13 (£965-£1,025) plus London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 27th June, 1960.

**HERTFORD DISTRICT**

**GENERAL ASSISTANT ENGINEER**  
(Ref. 962) (146/60.R).

Candidates should have had a good general and technical education and possess the Higher National Certificate or an equivalent qualification.

Salary N.J.B. Class G, Grade 12 (£710-£755).  
Apply by letter to W. H. Hutton-Ward, Assoc.I.E.E., A.M.B.I.M., Manager, Eastern Electricity Board, Bridgefoot, Ware, Herts., by 27th June, 1960.

**Suffolk Sub-Area**

**COLCHESTER DISTRICT**  
**THIRD ASSISTANT ENGINEER**  
(148/60.N).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems (including substations) at voltages up to and including 33 kV. Knowledge of D.C./A.C. changeover an advantage.

Salary N.J.B. Class F, Grade 9 (£815-£860).  
The successful candidate will be required to reside within reasonable proximity of Colchester.

Apply by letter to G. P. Dixon, A.M.I.Mech.E., Manager, Colchester District, Eastern Electricity Board, 36, Osborne Street, Colchester, Essex, by 27th June, 1960. 4912

**LONDON ELECTRICITY BOARD****Engineering Draughtsman**

**A**PPPLICATIONS are invited for the above position in the Board's Southern District at 54, Bengeworth Road, London, W.11.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen, and be experienced in one or more of the following subjects: office routine, electrical diagrams, layout of plant in transformer chambers, mains supply and recording of mains work.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £660 to £780 per annum, inclusive of London allowance.

Application form obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/2776/R. 4842

**THE CALTEX GROUP OF COMPANIES**

require a

## SENIOR INSTRUCTOR ELECTRICAL APPRENTICES

for the Training Division of their Indonesian Associates. The position calls for one-third theoretical lecturing in classrooms and two-thirds practical training in the workshop. Tours of duty are of two years' duration and based at Rumbai, Sumatra; there are generous leave provisions, allowances and pension facilities.

Applicants should be male, between the age of 25 and 45 years, and preferably possess an Electrical Engineering Degree. They should also have had at least three years' experience in teaching electrical theory and maintenance or a combination of suitable industrial experience and teaching.

Apply in writing to:—

**CALTEX SERVICES LIMITED**

Caltex House, Knightsbridge Green, London, S.W.1

quoting "SUM."

4860

**SOUTH EASTERN ELECTRICITY BOARD****SENIOR SALES REPRESENTATIVE,**

Dorking and Epsom District. Salary £640 × £20 to £700 per annum, under N.J.C. Grade 2. Superannuable. The person appointed will be required to give advice on supply matters, tariffs and appliance sales and installations for domestic and small commercial consumers. Applicants must be thoroughly conversant with all types of domestic electrical appliances and in addition to acting as an outside representative, must be prepared to carry out general showroom duties in any showroom within the Dorking and Epsom district. Applications quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 56, South Street, Dorking, by 29th June, 1960.

**ASSISTANT DISTRICT ENGINEER,**  
Hastings District. Salary £765 × £15 to £810, under N.J.B. Class F, Grade 10. Preference to applicants with technical qualifications up to H.N.C. standards and with practical experience of the operation, maintenance and construction of M.V. and 11 kV underground and overhead systems. The successful candidate will be expected to reside in or near Hastings. Applications quoting ER and naming two referees, to District Manager, SEEBOARD, 12/13, York Buildings, Hastings, Sussex, by 29th June, 1960.

GEORGE WRAY,  
Secretary.

4903

**STATION SUPERINTENDENT**

required by SIERRA LEONE GOVERNMENT Electricity Department on contract for two tours of 18/24 months each in first instance. Gross salary according to experience in scale £1,210 rising to £1,528 a year. Gratuity at rate 15% of total salary drawn. Outfit allowance £60. Children's allowances £48/£288 a year. Free passages for officer, wife and three children under 18 years. Liberal leave on full salary.

Candidates, between 21-40 years of age, must have served full apprenticeship with an electrical engineering company and have had several years' experience of operation and maintenance of power stations in a responsible position. They should preferably hold M.O.T. Certificate (Steam and Diesel) or equivalent. Good knowledge of power station electrical equipment desirable. Newly qualified mechanical engineers with some practical experience in steam turbines and diesel engines will also be considered at minimum of salary scale.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, qualifications and experience, and quote M2A/50789/EF. 4882

**YORKSHIRE ELECTRICITY BOARD**

**No. 5 (Wakefield) Sub-Area**  
**Doncaster District**

**ASSISTANT CONSUMERS' ENGINEER**  
(Development). The successful applicant will be required to visit and advise architects, builders, industrialists and consumers in the furtherance of electrical load development.

Preference will be given to engineers with appropriate technical qualifications who have had experience in the design of electrical space heating installations and in the organisation of exhibitions and lectures associated with load development projects.

Salary N.J.B. Class H, Grade 10, £860/£15/£905 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 24th June, 1960. 4821



### SALES ENGINEER FOR LONDON

**HEYES & Co. Ltd., Wigan, seek**  
**SALES ENGINEER** for London and the Home Counties. Ability to negotiate major contracts at the highest level essential; an established sales connection advantageous.

The successful applicant will have a wide responsibility to the Board for the execution of their planned sales policy.

Remuneration by good basic salary plus bonus which will produce total earnings commensurate with the standing required and the ability and experience sought. Car provided and out-of-pocket expense allowance paid.

Applications giving brief particulars of experience, present position and earnings should be sent in confidence to the Managing Director, Heyes & Co. Ltd., P.O. Box 60, Wigan. Full application forms will be returned to those considered suitable.

4878



**LANCASHIRE DYNAMO NEVELIN LTD.**

Hurst Green, Oxted, Surrey

**A**PPPLICATIONS are invited for vacancies which exist in the following categories:—

**SALES ESTIMATOR**

Estimator to handle enquiries and quotations for medium-voltage switchgear and motor control gear.

**ENGINEERS**

Contract design engineers with previous experience of medium-voltage switchgear, motor control gear, silicon and selenium rectifiers. Minimum qualifications H.N.C. Electrical or equivalent.

**DRAUGHTSMEN**

Senior and Intermediate Draughtsmen for design and development of power rectifiers, medium-voltage switchgear and motor control gear.

Applications in writing to Personnel Manager, giving full details of age, experience and qualifications.

4860

**SOUTH OF SCOTLAND  
ELECTRICITY BOARD**

Lanarkshire Area

Installation Engineers, Lanark and Rutherglen Districts

**A**PPPLICATIONS are invited for positions as **INSTALLATION ENGINEERS** in the Lanark and Rutherglen Districts.

Applicants should be trained as electricians with experience in all types of electrical installations and have a knowledge of the testing of installations and be conversant with the Electricity Supply Regulations (1937) and the I.E.E. Regulations for the Electrical Equipment of Buildings. Technical qualifications to Ordinary National Certificate or Higher Standard would be an advantage.

The salary and Conditions of Service will be in accordance with the National Joint Board Agreement, Schedule A. The classification and grading for the respective Districts is as follows: Lanark, E9, £765/£810; Rutherglen, G9, £860/£905.

Application forms which may be obtained from the undersigned should be forwarded to this office within fourteen days of the date of this advertisement.

R. J. RENNIE,

Montrose Crescent, Hamilton. 4904

**SOUTH OF SCOTLAND  
ELECTRICITY BOARD**

**A**PPPLICATIONS are invited for a superannuable position as a **FOURTH ASSISTANT ENGINEER** (Protection) in the Technical Section of the Chief Engineer's Department at Board Headquarters.

Candidates should possess a Degree or Higher National Certificate in Electrical Engineering and should preferably have had some experience in commissioning high-voltage electrical apparatus and routine maintenance and testing of protective gear. Previous experience at the works of a manufacturer would be an advantage. The scope of the work embraces equipment in the Board's generating stations and transmission system.

Salary N.J.B. Schedule B, Class AX/EX, Grades 7 and 8, £840/£1,065 or £735/£960.

Applications on the standard form, quoting reference E22/60, available from the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, should be returned not later than 1st July, 1960. 4883

**SOUTH WALES ELECTRICITY BOARD**

- (a) Second Assistant District Engineer  
(b) Commercial Assistant

**A**PPPLICATIONS are invited for the following positions in the Cardiff and East Central Area of the Board.

- (a) **SECOND ASSISTANT DISTRICT ENGINEER**, Cardiff District.

Salary N.J.B. Class J, Grade 7 (£1,095/£1,170).

Preference will be given to engineers possessing the H.N.C. in Electrical Engineering.

- (b) **COMMERCIAL ASSISTANT**, Barry District.

Salary N.J.B. Class F, Grade 7 (£910/£955).

Preference will be given to engineers possessing the H.N.C. in Electrical Engineering and who have had experience of engineering and commercial problems of supplies to large and small commercial and industrial consumers.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, Assoc.I.E.E., Manager, Cardiff and East Central Area, 445/447, Cowbridge Road East, Cardiff, to arrive not later than Friday, 8th July, 1960.

Envelopes should be endorsed (a) "Second Assistant District Engineer 123/60" and (b) "Commercial Assistant 124/60."

R. G. WILLIAMS,

Secretary. 4859

**NORTH WESTERN ELECTRICITY BOARD**

**Fourth Assistant Engineer, Design Section,  
Sub-Area Engineering Dept., Manchester**

**A**PPPLICANTS should have received a technical education to H.N.C. level, and preferably should have served an engineering apprenticeship or received equivalent training.

Duties include the preparation of schemes and estimates for extensions of a large city network and associated protective gear, together with work on re-equipping obsolete switchgear and high-voltage substations.

Salary scale £910 × £15 to £955 p.a., Grade M.13. N.J.B. conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 25th June, 1960.

Note: Applicants who responded to the previous advertisement of this post need not re-apply. 4840

**LIFT ENGINEERS**

**L**IFT ENGINEERS required for the erection and servicing of lifts in NIGERIA and GHANA. Wide experience of this work is essential and some knowledge of the more complicated high-speed installations would be an added advantage.

Appointments are to be made to the permanent staff and there are also contract vacancies for periods of 24 months. Salary dependent upon experience and terms of engagement but in the region of £1,300 to £1,500 per annum with free furnished quarters and generous allowances.

Full particulars of experience to—Box 4861.

**CENTRAL ELECTRICITY  
GENERATING BOARD**

Eastern Division

**A**PPPLICATIONS are invited for the following appointment:—

**GENERAL ASSISTANT ENGINEER,  
SOUTH DENES (Gt. Yarmouth)  
GENERATING STATION.**

Salary N.J.B., Class J, within the range of Grades 17/15, £560 × £15 to £700 per annum.

The commencing salary will depend upon the duties and responsibilities.

Duties of the above post include assisting in the electrical control room and experience in the technical operation of electrical, boiler house, and turbine house plant, testing, etc., in a generating station and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Applications, quoting Staff Vacancy Number 1338, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 25th June, 1960. 4892

**HEATING ENGINEER**

for leading manufacturers of electric floor warming system. Grad. I.H.V.E. minimum standard of qualification with experience in heat loss and design calculations. Scope and prospects in expanding organisation for individual with initiative and having electrical bias.

Full details stating salary required to Box 4847.

**AN ASSISTANT ENGINEER**

is required by a large public company in  
**HONG KONG**

He should preferably be under thirty-five. Applicant must hold a Corporate or Graduate Membership of the Institution of Electrical Engineers, or equivalent qualifications, and must have sound theoretical training and practical experience in the installation and maintenance of high and low voltage underground and overhead mains, static substation plant and distribution equipment.

Salary will be approximately £2,500 per annum, payable in Hong Kong Dollars. Rates of income tax in the Colony are low. First-class unfurnished quarters are provided and also free passages to and from Hong Kong, together with generous home leave on full pay. The company also has a Provident Fund and Retirement Scheme.

Applicants should write in the first instance to Box 4917, enclosing a recent photograph and giving fullest details of education, qualifications, experience, present position, age, marital status and the date available for leaving the U.K. Arrangements will then be made for suitable applicants to be interviewed in the U.K.

**CITY OF WAKEFIELD**

City Engineer's Department

**Junior Assistant Electrical Engineer**

Grade A.P.T.I. £610 × £30(4) × £35 to £765 per annum)

**A**PPPLICATIONS are invited for the above superannuable appointment in the City Engineer's Department.

The successful applicant will be engaged mainly on street lighting (maintenance and new installations) and on the supervision of various forms of electrical installations.

Preference will be given to applicants who hold the Ordinary National Certificate in Electrical Engineering and who have had previous experience in street lighting.

Applications stating age, qualifications and experience, together with the names of two referees, to be sent to the City Engineer, Town Hall, Wakefield, by 4th July, 1960. 4910

**EMP ELECTRIC LIMITED**  
Garman Road, Tottenham, London, N.17

**D**RAUGHTSMAN, age 25/30, required for design of H.T. protective equipment. Sound training in electrical engineering is essential, but experience in lightning arresters and H.R.C. fuses is not necessary. H.N.C. standard required. Pension scheme in operation.

Apply in full confidence to Technical Director, stating age, education, experience and salary required. 4873



## Situations Vacant (continued)

## PROFESSIONAL ELECTRICAL ENGINEERS

**MAKERS** of special-purpose rotating electrical machines from 1-500 kW require two qualified Electrical Engineers, one to work in the design team under the Technical Manager, and one to work on development projects under the Development Engineer.

The Designer must be works trained in the above products, A.C. and D.C., and should have 10-15 years' design experience, preferably with some experience of control schemes and/or electronics.

The Development vacancy is suitable for a graduate who has completed a graduate apprenticeship, is interested in electrical research and development work, and has some experience of control schemes and/or light current engineering.

Full details (in strictest confidence) of age, training, qualifications and experience should be sent, marked "Confidential," to the :—

Managing Director  
**MAWDSLEY'S LIMITED**  
Dursley, Glos 4887

## CITY OF LEICESTER EDUCATION COMMITTEE

Leicester College of Technology and Commerce  
Principal: R. E. Wood, M.Sc., F.Inst.P.

**APPLICATIONS** are invited for the post of **ASSISTANT (Grade B) IN THE DEPARTMENT OF ELECTRICAL ENGINEERING** for Ordinary National Certificate and City and Guilds of London Institute Electrical Installation and Electrical Fitters courses. Candidates should possess a Higher National Certificate in Electrical Engineering, or appropriate Final City and Guilds Certificates, with suitable industrial experience and, preferably some teaching experience.

Salary Burnham Technical Scale £700 to £1,150 per annum with appropriate allowance for approved qualifications, industrial and/or teaching experience.

Form of application and further particulars can be obtained from the Registrar, College of Technology and Commerce, Leicester, to whom completed forms should be returned as soon as possible. 4911

## CENTRAL ELECTRICITY GENERATING BOARD

### Midlands Division

**GENERAL ASSISTANT ENGINEERS** are required at Walsall Power Station for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, J14, £710-£755 per annum.

Applicants should have received a sound technical training and preferably have had some industrial engineering experience, and have as a minimum qualification the Ordinary National Certificate.

Apply quoting vacancy number 141/60MD, on forms AE6, which are available from the Station Superintendent, Walsall Power Station, Reedswood Lane, Birchills, Walsall, Staffs., to whom they should be returned when completed not later than 27th June, 1960. 4908

## ESTIMATOR

**EXPERIENCED** man (25-45) required to assist in preparation of tenders for general light engineering work. Practical shop floor experience desirable as well as a ratefixing/time study/estimating background and ability to interpret drawings.

Applications to Personnel Manager, Phoenix Telephone & Electric Works Ltd., The Hyde, Hendon, London, N.W.9.

## ELECTRICAL CONTRACTORS

have the following vacancies in their Manchester Office:

(a) **SENIOR DESIGN ENGINEER** capable of working without supervision and having a wide experience in the design of lighting and power installations, control and instrumentation cabling on large industrial and commercial projects.

(b) **ESTIMATING ENGINEERS** of proved ability in the preparation of detailed estimates for all classes of installation and cabling work, both in this country and overseas.

Applications in own handwriting, stating age, educational background, qualifications, experience and salary required to :—

The Manager  
**DRAKE & GORHAM (CONTRACTORS) LTD.**  
21, Newton Street, Manchester, 1 4756

## CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division  
(Vacancy No. 157/ER/60)

**APPLICATIONS** are invited for the appointment of **ASSISTANT SHIFT CONTROL ENGINEERS** at USK MOUTH A and B POWER STATIONS, NR. NEWPORT, MON. Salary: Initially K.12, £860-£905 per annum plus 10% shift enhancement, rising progressively to M.12 (£965-£1,025 per annum) plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications, and have had experience in a modern power station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 1st July, 1960. 4909

## SENIOR ELECTRICAL DRAUGHTSMEN

required

with experience of distribution, power and lighting schemes, diagrams, control gear, cabling and D.O. routine.

O.N.C. preferable but not essential. Evidence of training and ability required.

Full details of age, training, experience and any qualifications should be sent to Chief Electrical Engineer, Dorman Long (Steel) Ltd., C.E. and P.C.D., G.P.O. Box 11, Royal Exchange, Middlesbrough. 4774

## DRAUGHTSMEN REQUIRED BY LIGHTING EQUIPMENT MANUFACTURER

**A GOOD** opportunity for young draughtsmen arises in the London office of a well-known and established manufacturer of a variety of specialised lighting fittings. Some work experience or training preferred.

Convenient to Victoria and Waterloo stations. 5-day week, contributory pension scheme. Write fully to—Box 4753.

## ELECTRICAL ENGINEER

Electrical contracting organisation invites applications from Design/Estimating Engineers capable of working on own initiative on all classes of power, heating (including floor warming) and lighting installations.

This is a superannuated position offering considerable opportunity in a growing concern for an engineer aged 30-40.

Applications which will be treated in strict confidence, giving details of qualifications, experience, age and salary required, should be addressed to Associate Director, Scull Electrical Ltd., Lumens House, William Street, Bristol, 3. 4916

## ELECTRICIANS

**FULLY** qualified electricians required for general maintenance and installation work on large integrated iron and steel works. Excellent conditions; pension scheme in operation.

Apply to The Employment Officer, Appleby-Frodingham Steel Co., Scunthorpe, Lincs. 4891

**A LEADING** transformer oil company requires the services of a suitably qualified electrical engineer for marketing their products in the North-Eastern area. I.E.E. member preferred. Salary according to age and experience.—Box 4848.

**A N** engineer representative required in the Midlands area for the sale of switchgear, fuse distribution gear and accessories. Applicants should have sound electrical knowledge and sales experience. A connection amongst users, contractors and wholesalers in the area is desirable. Full details of experience, salary required, etc., to—Wm. Sanders & Co. (Wednesbury) Ltd., Ridding Lane, Wednesbury. 4849

**A GENT** required for the London area by a firm engaged in the manufacture of domestic electrical appliances; must have live connection amongst all the wholesalers in London and the Home Counties. Apply in strictest confidence giving full details to—Box 4920.

**A SSISTANT** electrical engineer required by a national newspaper. Age 25/26. Electrical apprenticeship and Higher National. Must be first-class electrical draughtsman. Good prospects.—Box 4696.

**A SSISTANT** supervisor required by South Coast electrical contracting company. Experienced in all types of installation work; superannuation scheme available. Please write giving qualifications, etc., to—Box 4850.

**A SSISTANT** works manager required for independent electric lamp factory. Preference will be given to young and energetic man, conversant with the processes in electric lamp manufacture, who is willing to establish for himself a permanent position. All applicants will receive replies and be treated in strictest confidence.—Box 4918.

**A UTOMATION**, circuitry engineer, also draughtsman, for contractor electrical control gear for automation and related schemes including control of machine tools, conveyors, etc. Estimating experience an advantage (engineer). Permanent position, H.N.C. and O.N.C. respectively (or equivalent qualifications) preferred. Good starting salary with excellent prospects of progressive remuneration. Write in confidence, giving full details of previous experience, qualifications, age, salary expected to Technical Director, The Donovan Electrical Co. Ltd., Stechford, Birmingham, 33. 4888

**BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd.**, Longridge House, Manchester, 4. Electrical surveyors required in Ireland and Scotland. Permanent positions carrying progressive salary scale £800 to £1,100 and non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. 4865

**CONTROL** circuit engineer and estimator for automatic motor control gear; O.N.C. or H.N.C. desirable with previous experience; permanent and pensionable situation. Apply giving details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey 129

**CROMPTON PARKINSON LTD.** require a senior transformer designer for their Hayes works, Middx. Applicants should have degree or H.N.C. and preferably some years' experience with transformers up to 20,000 kVA and 66 kV, with on load tap changing gear. Write with full particulars of age, education, qualifications and salary required to the Personnel Officer, Clayton Road, Hayes, Middx. 4921

**DRAUGHTSMAN** (junior) electro/mechanical; interesting situation with excellent prospects. Apply giving full details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 130

**DRAUGHTSMAN** required for switchboard layout. Over 21 years. 5-day week. Pension scheme. A.E.S.D. rates.—Auto Diesels Ltd., Uxbridge (Tel. Uxbridge 8262). 4683



**E**LECTRICAL contractors require an estimator for industrial and commercial installations. Only fully experienced men who are conversant with all types (including FLP) need apply. Please write stating experience, qualifications and salary required to—Box 4622.

**E**LECTRICAL development. A junior electrical engineer required to assist in the development of small electro-mechanical assemblies. Duties will include experimental work, the testing of prototype and line products, and development and construction of test rigs and apparatus. Preferably aged 21-25 years, have served an apprenticeship and hold O.N.C. (Electrical). Apply—D. H. Bonnell & Son Ltd., West Hill, Hoddesdon, Herts (Tel. Hoddesdon 2283). 4851

**E**LECTRICAL draughtsman required with H.N.C. or equivalent. Knowledge of factory installation work desirable. Non-contributory pension scheme. Excellent canteen facilities. Food factory in London area. State experience and salary required.—Box 4788.

**E**LECTRICAL engineer required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., 98, West George Street, Glasgow, C.2. 4866

**E**LECTRICAL engineer with wide experience of estimating for large industrial and commercial installations. Apply in writing giving age, experience and qualifications to—W. J. Furse & Co. (Manchester) Ltd., 20, Mount Street, Manchester, 2. 4829

**E**LECTRICAL engineer-surveyor for routine inspection of all types of electrical plant installed in a large group of engineering factories. All applicants should have had extensive experience with this type of plant and good theoretical knowledge. Pension scheme. Apply stating age, experience, qualifications and salary required to Personnel Manager, T.I. (Group Services) Limited, Rocky Lane, Aston, Birmingham, 6. 4828

**E**LECTRICAL staff required by consulting engineer for installation design on interesting projects for industry and commerce. Two grades: (a) engineer/draughtsman, age 20/27; (b) junior draughtsman, age 16/20 (with educational facilities). Meal vouchers, 5-day week, superannuation in higher grades. State age, experience, salary required.—G. H. Buckle & Partners, 2, Harrington Gardens, London, S.W.7. 4852

**E**NGINEER required with experience of development or testing of house service electricity meters. Higher National Certificate preferred.—Box 7551.

**E**XPANDING firm of consulting engineers, with international reputation, require intelligent electrical engineer/draughtsman, aged 19 to 25, to assist senior electrical engineers in the design and supervision of electrical installations in buildings of all types. Ideal situation for a man having recently completed his apprenticeship. Proved ability would result in greater responsibilities leading toward a position as a senior electrical engineer. Write—Stensen, Varming & Mulcahy, 146, New Cavendish Street, London, W.1. 4889

**H**EATING and ventilating engineers have an opportunity for assistant electrical engineer to be responsible for the preparation of wiring diagrams and site inspection of installations. Write giving full details and salary expected to Mr. A. Davey, Norris Warming Co. Ltd., Burley House, Theobalds Road, London, W.C.1. 4853

**M**AGNETIC amplifiers. Engineers required to design and develop magnetic amplifiers for various control applications. Some experience in this field is essential. Apply to Haddon Transformers Ltd., Victoria Park Industrial Estate, Field End Rd., Ruislip, Middx. 4890

**P**RODUCTION engineer required for electrical trade. Paddington (London) area.—Box 7561.

**R**EPRESENTATIVES required calling on wholesalers and retailers for most competitive distributors in the trade. Accessories, lamps, fittings and appliances. Only top-rate men with electrical trade connections need apply.—Universal Distributing Co. Ltd., 66/68, Great Eastern Street, London, E.C.2 (Phone, SHORE-ditch 8282). 4415

**S**ALES engineer required with established connection and knowledge of off-peak storage heaters or motor control gear, preferably living North of Thames. Excellent prospects for man of initiative. Car provided.—Box 7556.

**S**ALES engineers. Young engineers over 21 years required for indoor staff of sales department. Technical and works training in electrical engineering practice, at least to O.N.C. standard, is required by West London engineering company specialising in explosion-proof and industrial electrical control gear as well as other electrical equipment for industry. Candidates, in replying, should state age, training, qualifications and anticipated remuneration, in confidence, to—Box 182.

**S**ALES representative (male) required in the Gloucester district. Duties will include advice to consumers on matters concerning supply, tariffs, apparatus sales, wiring and installation thereof. Salary £525/£625 per annum (N.J.C. Grade 1). A training scheme is in operation and salary is paid during training. Apply by letter, within 14 days, stating age, qualifications, experience and present salary to—Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester. 4854

**S**ALES representative required for London area by a firm engaged in the manufacture of domestic electrical appliances; must have live connection amongst all the wholesalers in London and the Home Counties. Apply in strictest confidence giving full details to—Box 4919.

**S**AO PAULO LIGHT S.A.—Serviços de Eletricidade, a company in Brazil and a subsidiary of the Canadian corporation Brazilian Traction, Light and Power Company Limited, invite applications from suitably qualified men for the position of deputy chief of its Piratininga Power Station. The power station was completed about five years ago and is situated near Sao Paulo (population over 3 millions; temperate climate, 2,200 ft. above sea level). The plant comprised initially 2 × 100-MW, 1,800-r.p.m. steam turbo-generator units each supplied at 850 p.s.i., 900° C. by one 850,000-lb./hr. oil-fired boiler, and has been recently expanded by the addition of two 125-MW reheat units, 1,800 p.s.i., 1,000° F. Applicants should have sound technical knowledge and good practical experience in the administration, operation and maintenance of steam-electric power stations; should also be of strong character with an aptitude for supervision and the maintenance of harmonious labour relations. Good salary, three years' agreement with first class passage both ways; four months' paid leave after three years' service. Written application in the first instance should be made to Mr. Osborne Mitchell, General Manager, Canadian-Brazilian Services Limited, 9/12, Cheapside, London, E.C.2. 4875

**S**ECTION leader distribution switchboard assembly, apprentice trained. Small composite works N. London. £16 weekly with prospects. Staff and pension benefits.—Box 4862.

**S**ENIOR and junior electrical design engineers/draughtsmen required for consulting engineers' office. 5-day week, luncheon vouchers, spring and summer holidays. Applicants for senior positions must be experienced in design of electrical services for modern hospitals, universities, factories, etc. Please apply stating age, experience and salary required to—J. Stinton Jones & Partners, 21, Gloucester Place, London, W.1. 185

**S**ENIOR electrician for first-class electrical installation work required by well-known concern. Two years overseas. Good opportunity. Write age, experience, copy references.—Box 4809.

**S**TORES assistant (junior) required by electrical wholesalers. Opportunity to learn trade. Good prospects. Apply—Supra Elec. Co. Ltd., 26, Soho Square, London, W.1. 4827

**S**UPERVISING engineer. Must be experienced estimator in all types of commercial and industrial electrical installations. Write full details of training and experience to the Manager, F. H. Wheeler & Co. Ltd., 52, Elswick Road, Newcastle upon Tyne, 4. 7550

**S**UPERVISING electrical engineer required. Must be fully capable of and have experience in estimating for and carrying through to finalisation all types of commercial and industrial installations. Good salary, car allowance. Permanent and progressive position. Pension and staff bonus schemes. Write in confidence.—Cable Jointers Limited, 229, High Street, Acton, London, W.3. 4914

**T**ECHNICAL assistant required in electrical and mechanical engineering section of chief engineer's department, with experience of modern electrical and mechanical installations in large buildings. Experience of heating and ventilating an advantage. Graduate or associate membership of recognised professional body preferred. Up to £950 according to qualifications and experience. Pension scheme. Staff restaurant on premises. One Saturday only worked in five. Form from Chief Engineer (GS/ER/1416/6), L.C.C., County Hall, London, S.E.1. (N.B.: Salaries quoted above are subject to a salary settlement shortly to be confirmed.) 4863

**T**ECHNICAL sales engineer with a background in small induction motor design and manufacture required for new appointment responsible for sales (with secondary production responsibilities) of special purpose motors forming small but important sector of international mechanical handling company's products. West of London area. Salary about £1,200, plus car.—Box 4922.

**T**EST engineer required for test department of loading control gear manufacturers having experience of control gear for machine tools heating and ventilating and pumping applications, etc. First-class working conditions, modern premises, bonus scheme after qualifying period. Apply—M.T.E. Control Gear Ltd., Progress Road, Eastwood, Leigh-on-Sea. 4923

**T**RANSFORMER designer required for large established factory in Bombay to work as manager responsible for design and manufacture of transformers up to 15 kVA and 132 kV. Good academic qualifications with minimum 10 years' experience essential. Age 30 to 40 years. Bachelor preferred. Assignment on 3 to 5 years' contract. Excellent prospects. Apply with full particulars, including salary required, to—Box 4876.

**W**ORKS manager required for switchgear factory in Scotland. Must be capable of developing organisation and taking full control. Excellent prospects offered to right class of man having switchgear experience. All applications will be considered in strict confidence by the Managing Director.—Box 4924.

#### APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

#### SITUATIONS WANTED

**E**LEC. eng. (39), exp. home/overseas, mining/electronics/winding, bilingual, Port., some Span., seeks post. References.—Box 7562.

**E**LECTRICAL-mechanical engineer with many years' experience on large power stations and systems, specially hydro-electric. Specialist on construction, maintenance and preventive maintenance. Seeks further employment anywhere. Recently six years in India. Good references.—Box 7548.

**E**XECUTIVE requires responsible position. Experienced all aspects electrical contracting, including sales and service; factory installations, A.M. contracts.—Box 7559.

**I**N desperation. Representative in early fifties requires a position as representative in Lancashire and Cheshire (good connections). From 1933 to March, 1959, he supported widowed mother and family. Good references.—Box 7555

**S**ALES liaison engineer with good knowledge of cable, lighting, distribution, radio and telecommunications equipment, possessing established connections with E.E. Board, industry and municipalities in East Anglia, desires to join firm wishing to improve their technical representation.—Box 7552.

**S**ENIOR sales representative (38) seeks advancement. Wide experience and contacts with Government departments, nationalised industries, large users, etc.—Box 7558.

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## Situations Wanted (continued)

**TURBINE** erector, age 36, site engineer, returning U.K. July after prolonged service abroad, open to engagement in responsible capacity on power plant erection, maintenance or similar work, preferably abroad.—Box 7549.

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By Order of the  
SECRETARY OF STATE FOR WAR  
Fuller Horsey Sons & Cassell

have been instructed to include in the SALE by AUCTION in Lots at the ROYAL ARSENAL, WOOLWICH, LONDON, S.E.18, on TUESDAY, 5th JULY, 1960, and following day, at 10.30 a.m. precisely each day—

5,354 ELECTRONIC VALVES, types CV.2721, CV.4002, CV.4038, CV.4054, CV.4069, VX.8142 and VX.8190. RADIO and ELECTRICAL EQUIPMENT; RADAR and RADIO SCRAP; PRISMATIC and MAGNETIC MARCHING COMPASSES; 3,850 PAIRS BINOCULARS and 2,170 STOP and POCKET WATCHES.

Catalogues, 1s. each, admitting two persons on View Days (Wednesday, Thursday, Friday and Monday preceding Sale) and one on Sale Days, may be had, when ready, from the AUCTIONEERS' OFFICES, Department X, 10, Lloyds Avenue, London, E.C.3. 4925

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## 3.600 H.P. SLIPRING MOTOR FOR SALE

3-phase, 50 cycles, 297 r.p.m.  
ventilated

EXCELLENT CONDITION  
NEW 1952

CAN BE DELIVERED WITH  
GUARANTEE

We hold a large stock of

ELECTRICAL MACHINERY,  
STEAM and DIESEL SETS,  
etc.

INGENIORSFIRMAN  
**MYRÉN & CO.**

Gothenburg  
Sweden

Cable: ELEKTROMYRÉN, GOTHENBURG

## HOUSE SERVICE METERS

**200** -240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.  
221, City Road, London, E.C.1

37

## 600

## WARD LEONARD SETS

All incorporating motor generator sets comprising slipring motors normally 1,440 or 960 r.p.m., with direct coupled generators and excitation equipment, together with A.C. and D.C. control gear.

## TYPICAL WORK MOTORS

H.P.	Maker	Voltage	Speed
0/840	E.E.C.	0/480	0/1500
0/225/225	HARLAND	0/250	0/1450/1750
0/200	W'HOUSE	0/230	0/1750
0/160	CROM.PARK.	0/480	0/1000
0/150	MET. VICK.	0/500	0/1500
0/130/150	M. & PLATT	0/500	0/360/500
0/130	L.D.C.	0/220	0/1000
0/100/100	L.D.C.	0/220	0/750/960
0/95	ALLEN	0/220	0/1300
0/60/60	ALLEN	0/230	0/1300/1500
0/74	L.S.E.	0/480	0/2900
0/60/60	E.E.C.	0/500	0/2000/2900

Others available down to 3 h.p. Wide choice of speeds all covered by guarantee.

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Sons & Co. Ltd.

Wood Lane, London, W.12  
(Shepherds Bush 2070)  
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4855

**A.A. ELECTRICAL Co.** for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI.5105. 67, Rothschild Rd., London W4. 57

**A** BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

**A** C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

**A** C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

**A** LTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

**A** LTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLerkenwell 5512). 24

**B** ARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

## 600

## COMMUTATOR MOTORS

400/440/3/50

H.P.	Make	Speed	Remarks
67.5/270	B.T.H.	95/370	Schrage
35/70	B.T.H.	650/1300	Schrage
20/40	B.T.H.	300/1000	Schrage
20/40	B.T.H.	45/90	Geared
1.5/5	L.S.E.	900/3000	Ind. Reg. Control
3/3	L.S.E.	800/3000	Ind. Reg. Control

## 400 CPS ALTERNATORS

New, 5 kVA, 115/200 volts-3-400 cps, dual voltage (delta/star) sinusoidal wave form, 3,000 r.p.m. Rectifier excited with A.V.R. Ex stock.

Other sizes up to 40 kVA for short delivery.

**GEORGE COHEN**  
Sons & Co. Ltd.

Wood Lane, London, W.12  
(Shepherds Bush 2070)  
Stanningley, Nr. Leeds  
(Pudsey 2241)

4791

**B** ILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

**C** ABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

**C** ABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYAL 5905). 316

**C** IRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

**C** ONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

**C** RANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

**C** HRYSLER diesel generating plant. Electric start, 37½ kVA, 440/3/50. Complete with comprehensive control panel. Brand new heavy duty starter batteries. The whole plant in magnificent condition and equal to new. £550.—Speed Electrics, Dept. ER., Church Street, Basford, Nottingham (Tel. 75716). 4793

**D** IESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

**E** LECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (CLerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

**E** LECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

**E** LECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

**E** LECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

**E** LECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.); 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

**F** LUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Olive Street, Bury (Telephone, Bolton 7251). 212

**F** OR sale, good, unused and used machinery, including electric motors, A.C. and D.C., dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyle, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

**G** ENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

**K** ARDEX, Roncodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

**M** OTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. CLerkenwell 5512, 5513 & 5514). 12



**MOTORS** and control gear, huge stocks all types,  $\frac{1}{2}$  to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (3774/5/6). 70

**NAMEPLATES**, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

**OFFERS** are invited for 8 British Trane electric fan heaters (4 20kW and 4 10kW), 415 volts, 50 cycles, complete with contactors. Apply—Supt., Prince of Wales Road Baths, London, N.W.5 (GUL. 3678). 7554

**PHASE** converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

**PLATING** dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

**POLYPHASE** kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

**PREPAYMENT** 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

**PURLEY** chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. F. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

**QUARTERLY** credit meters, single and polyphase, 2½-100 amps. From 20/- Also D.C. See Television.—Tradex, Surbiton. 171

**ROTARY** converters in stock, all sizes; enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

**SMALL BR** screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

**TELEVISION** slotmeters and time switches. Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

**VENNER** time switches, 200-240 v., A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

**WARD** Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-36, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

**2-speed** motor, 40/20 h.p., 950/480 r.p.m., T.E.F.C. slipping type by L.D.C. with Igranic automatic control panel. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 78

**180-h.p.**, 970-r.p.m. T.E.F.C. slipping motor by Lancashire, 400 v., 3-phase, 50 cycles, complete with fully automatic starting panel. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 77

**300-kW** mercury arc rectifier, input 6,600 volts, output 500 volts, 600 amps., with tapings, by E.C.C. Equipment about 4 years old, practically unused. Price £1,250, original cost £4,000.—Davidsons Engineers (M/cr) Limited, Irkdale Street, Smedley Road, Cheetham Hill, Manchester, 8 (Telephone No. COLlyhurst 1610). 4794

**400-cycle** to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

**500/625-kW** L.D.C. generator, 240 volts, 2,080/2,600 amps., D.C., compound interpolate with single bearing for direct coupling at 1,000 r.p.m., or on combination belt with new L.D.C. slipping motors, 900 h.p., 990 r.p.m., 3.3 kV or 6.6 kV, complete with switchgear, in approximately six months. Also duplicate generator and spare armature. Further details from Dynamo & Motor Repairs Ltd., North End Road, Wembley. 84

**500-kW**, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

#### EQUIPMENT FOR HIRE

**GENERATING** set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service.—Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

#### ARTICLES WANTED

#### WANTED

D.C./A.C. Motors, Transformers, Cables and all redundant Power Station Plant wanted for dismantling.

#### ASK US TO QUOTE

B. M. T. CO. LTD.  
London Road, Barking  
(RIP. 3387/3715)

298

A.C./D.C. electric motors, generators, transformers, disused stocks of cable, power houses bought and dismantled.—Samuel Hyams, 129, Lambs Lane, Rainham, Essex (Rainham 4896). 125

**HARRINGTON** & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc.—109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

**MERCURY** (Quicksilver) wanted. Write for packing instructions. Gold, silver and platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Rd., Watford (Tel. 5963). 114

**MOTOR** wanted, 175/200 h.p., 585 r.p.m. preferred, but 720 r.p.m. possibly acceptable. Protected slipping, 3,000/3,300/3/50 c., with or without starter gear. Offers to—J. Jones & Co. (Nottingham) Ltd., 28/30, Canal Street, Nottingham. 4856

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**SILICON** steel offcuts required.—Box 138.

**WANTED**, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

**WANTED** for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

**WANTED**, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

**WANTED**, surplus stock cable, all types and sizes. We can inspect.—Box 220.

**WANTED**, 24/30-v. D.C. generator giving 10 amps. continuous at 900/3,000 r.p.m. Prefer ex-W.D.; (also) single or 3-phase alternator giving single-phase, 230-v. A.C. output in range 700 watts at 1,500 r.p.m.—Box 7560.

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from all interested **AGENTS**  
who would like to carry our

**Washers.**

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4879

#### AGENCIES WANTED

by well-established company having business with and representatives calling on Electricity Boards, etc., in U.K.

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**AGENCIES** required for cable, conduit, accessories, etc., for wholesalers in Lancashire and Cheshire, by salesman 30 years' experience and connection, good contacts.—Box 7553.

**BRITISH** agents having large ramifications within the electrical field seek additional agencies from Continental manufacturers of electrical accessories, small domestic electric appliances, etc. Substantial references and ample finance available.—Box 119.

**WELL**-established sales organisation with London offices and storage, extensive connection with electrical wholesalers, boards, stores, etc., are interested in good exclusive agencies, particularly Southern half England.—Box 4926.

**DISTRIBUTORS** wanted for automatic washing machines (made in Italy). Closed areas. Reply to A. H. Squire, 16, Ederoyd Avenue, Stanningley, Pudsey, Yorkshire. 7557

#### WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honey-pot Lane, Stanmore, Middx. 92

**ENGRAVED** nameplates and labels in all materials.—A. T. Brown & Co. Ltd., 347-349, Katherine Road, Forest Gate, London, E.7 (Tel. Grangewood 1024). 198

**PRODUCTION** winding of armatures, stator, coils, transformers. Also special motors. Prompt and reliable deliveries.—Lewis Electric Motors Ltd., Moor Wks., Maidenhead, Berks. 194

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**ELECTRICAL** contracting business required, preferably but not essentially with retail connection in Midlands area. Suggested minimum turnover £25,000 p.a. All replies in strictest confidence.—Box 4811.

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## COMPANY MEETINGS



## ANOTHER SUCCESSFUL YEAR

### VOLUME OF NEW BUSINESS AGAIN A RECORD

#### OVERSEAS COMPANIES' CONTINUED PROGRESS

#### MR. W. STUART PHILCOX'S STATEMENT

THE 31st Annual General Meeting of Telephone Rentals Limited was held on 8th June at the Registered Office, 197, Knightsbridge, London, S.W.7, Mr. W. Stuart Philcox, D.F.C., M.A. (chairman and managing director) presiding.

The Secretary (Mr. W. J. H. Ainley) read the notice convening the meeting and the report of the auditors.

The following is the statement by the Chairman which had been circulated with the report and accounts for the year ended 31st December, 1959:—

Before commenting on the results of the year under review, I must refer to the loss we have suffered through the death on 14th August, 1959, of the founder of our business, Mr. Fred. T. Jackson.

As a matter of history, Mr. Jackson began his business career in 1902 with one of the four private telephone installation companies then existing in this country. Following the outbreak of the first World War he formed the original Telephone Manufacturing Company Limited to take over the rental companies and to manufacture the equipment required by them. In 1929 this company went into voluntary liquidation in order that two new and completely separate public companies might be formed, one with the same name to concern itself solely with manufacturing, and the other—Telephone Rentals Limited—to take over and to develop the rental interests.

Up to the day of his death, the progress and well-being of these two companies never ceased to be Mr. Jackson's predominant interest, and as will have been seen his total service amounted to fifty-seven years.

It would be almost impossible in a few sentences to pay adequate tribute to the qualities of this man. We have therefore sent to each shareholder a copy of the Memorial issue of our T.R. Journal which demonstrates as no words of mine could do the remarkable esteem and high regard in which he was held by so many both inside and outside your Company.

Telephone Rentals has a very strongly developed family spirit and it is as the head of a family that we shall miss him most.

#### Board Changes

Towards the end of the year I was elected by my colleagues on the Board to the office of Chairman in place of Mr. Jackson, and it will be my constant endeavour to maintain the high standard of devotion to the Company's interests set by him.

During the next four or five years your Company is likely to be faced by many problems brought about by the rapid rate of change in many fields in which it operates and during that period it will be passing from what might be termed the old management to the new.

With these thoughts in mind, we decided to extend invitations to join the Board to two gentlemen who for many years have been well acquainted with the activities of your Company and who have a wide knowledge and experience

of affairs in general. I am glad to say that in both cases our invitations were accepted and you will be asked to confirm these appointments at the Annual General Meeting.

One is Mr. F. C. T. Lane who, until his recent retirement, was senior partner in the firm of Chas. W. Rooke Lane & Company, who from the very early days have been our Auditors. The other is Mr. J. H. Reed, Managing Director of Ericsson Telephones Limited, with which Company we have had a very close working arrangement for over a quarter of a century. I should perhaps emphasise that there is no financial association whatever between your Company and Ericsson Telephones Limited and that we have invited Mr. Reed to join us in his personal capacity.

At the same time, we have taken advantage of Article 87a in our Articles of Association and have appointed as Executive Directors four of our senior personnel. These gentlemen are Mr. E. H. Cooper, General Manager, Mr. C. Cleverdon, General Sales Manager, Mr. T. Sedgwick, Chief Engineer, and Mr. E. A. Bradshaw, Manager of our largest operating branch.

I think you may be interested to know that on 31st December, 1959, the average age of the Executive Directors was 53 and that their average length of service was 32 years. We are particularly fortunate in being able to number among our staff such a high proportion who joined us as young men and who have decided to make their careers with the Company. This is certainly not the least of the factors accounting for the family spirit which exists among us and to which I referred just now.

I believe it is true to say that your Company has a good reputation for sound and understanding management, and I have no doubt that the increased opportunity for combining detailed internal knowledge and wide external experience inherent in the steps we have taken will be of great advantage to us during the next few important years.

Before leaving the subject of the Board of Directors I wish to call your attention to the Special Resolution which will be submitted for your approval at the Annual General Meeting. The effect of passing this Special Resolution will be to increase the basic remuneration to which the Directors are entitled from £400 to £750 per annum and the basic remuneration of the Chairman from £500 to £1,000. The present rates have remained unchanged since the incorporation of the Company in 1929, and it is considered reasonable that this increase should now be made.

#### The Year's Trading

I am very glad to be able to report that once again your Company has had a very successful year. In this country, in spite of increased competition, the amount of new business we did was again a record. Not only was there an increase in the total number of contracts both with new and existing subscribers, but the number of contracts for large installations

included in the total was considerably greater, whilst the business was widely spread over the full range of T.R. services.

This success was of course largely due to the upsurge in industrial production which developed throughout the country during the course of the year, but it also reflected the concentrated attention paid to training and instruction on the sales side in recent years. In a highly specialised business such as ours it takes a long time to build up and maintain a skilled and experienced sales force trained to act in a consultative capacity, and our strengthened financial resources have enabled us to carry out our planned training programmes without the threat of interruption with which we were so often faced in the early nineteen-fifties.

The larger volume of business has naturally added greatly to the burden of work in the engineering and clerical departments at Head Office and in the Branches.

On the engineering side, we have also reaped the benefit of the time and money which for many years have been invested in training and instruction both at our Central Training School and in the field. Our engineers have shown themselves to be anxious to take responsibility and to improve their skill and knowledge, with the result that the work in installing and maintaining a continually widening range of equipment has been carried out with a high standard of workmanship and with increased efficiency and economy.

Included under the heading of training and instruction is our Apprenticeship Scheme which at present covers between eighty and ninety apprentices. The apprentices of today will be the engineers of tomorrow, and I am glad to be able to pay a tribute not only to the keenness and application of the youths themselves but also to the understanding interest taken in them by the older men under whom they work.

During the year under review we completed a quite extensive programme of mechanisation and reorganisation of routines and procedures in the offices. On this account we were able to deal with the greater volume of work referred to above with much less pressure and much more economy than would otherwise have been possible. These measures will greatly assist us to keep under control the rise in overhead expenditure that is one of the inevitable consequences of an expanding organisation.

Our subsidiary company, Electro Rentals Limited, which deals solely with refrigeration on rental, has continued to make steady progress. Certain changes in its sales policy may well lead to an accelerated rate of growth in the future.

#### Overseas

I can also report that our overseas companies have continued to make satisfactory progress. Although these companies still form a relatively small part of our total enterprise, they are growing rapidly and will undoubtedly make a valuable contribution to the strength of the Organisation. Trading conditions obviously



fluctuate from time to time in any one country, including Great Britain, and these overseas operations will add to the stability of your Company.

We believe that it is very necessary to maintain close personal contact between these companies and ourselves, and during the year a number of visits by senior executives were made in both directions, including a visit by myself to Australia and Canada.

All the overseas companies, with the exception of Canada, traded at a profit during the year and all, except Canada and Paris, paid a dividend either direct or, in the case of South Africa, to our holding company there, Telephone Rentals (South Africa) (Pty.) Limited.

We anticipate that Paris will be in a position to pay a dividend at the end of the current year, but it will still be some years before Canada will be similarly situated. We tend to forget how long it took to establish a profitable rental business in Great Britain during the first quarter of the present century and we shall be wise to reconcile ourselves to a long period of relatively slow progress in Canada.

### Dividend

As the result of all these activities the Consolidated Profit before Tax amounted to £1,294,581, which represents an increase of £170,521 on the previous year and is the highest we have so far achieved.

Taking all factors into consideration, your Directors feel justified in recommending a final dividend of 10%, making, with the interim dividend paid in January, 1960, a total for the year of 15%.

As we have found from hard experience, it is most desirable that a company of this nature should as far as possible be able to finance its operations from its own resources. As has been repeatedly stated in the past, the Board would not be prepared to recommend an increased dividend if there was a risk of the liquid resources of the Company being seriously weakened or if the future prospects seemed to make it unlikely that the increased rate could be maintained.

At the present time our liquid resources are satisfactory and I am glad to say that during the first four months of the current year there has been no falling off in the level of business. Unless some completely unforeseen circumstances should arise, we therefore feel we may reasonably anticipate maintaining the payment of the dividend at 15%.

I should perhaps point out that there might be a danger of interpreting the figures of our liquid resources too literally and of failing to view them in proper perspective. The sudden and to some extent unforeseen uprise in the volume of business in the middle of 1959 had the double effect of running down our stocks and of lengthening the delivery period from our principal suppliers. We now find it necessary to plan for a much higher stock level than was required a year or two ago and we estimate that during the current year we shall spend about £1,000,000 more on materials and equipment than we did in 1959.

Turning to the Accounts now before you,

I will comment briefly on some of the changes as compared with the previous year.

### Profit and Loss Account

Trading income is up by £204,691, Dividends and Interest receivable by £30,656, whilst on the other side Operating Expenses are up by the moderate sum of £16,688, Directors' Emoluments by £21,925 and Depreciation by £30,524.

The increase in Directors' Management Emoluments, which include the emoluments of the four Executive Directors from the date of their appointment, is principally accounted for by special payments to the late Chairman's estate arising under the terms of his Service Agreement on his death and to that extent is non-recurring. The net Profit before Tax at £1,213,827 exceeds the 1958 figure by £166,210.

Profits Tax is down by £12,928 and Income Tax is up by £30,894. Both these items have been affected by the restoration in the 1959 Budget of the Investment Allowance, applicable as from the 8th April, 1959.

The Net Profit after Tax, but before transfers to Reserves and provisions for Dividends, is £785,853. We have transferred to the Tax Equalisation Reserve £76,000, which is £91,000 less than was required in 1958, mainly due to the special adjustment made last year to cover the difference in basis of the Profits Tax Levy. The sum of £430,420 has been transferred to the General Reserve.

After providing for the transfers to Reserves, and the Dividends on both the Preference and Ordinary Shares amounting to £243,873, as compared with £187,494 in 1958, we are left with an unappropriated Profit balance of £232,255 to be carried forward to 1960. The increase in the amount of the Dividends is accounted for by three things: firstly, the reduction in the standard rate of Income Tax which affects the Preference and the Interim Dividend on the Ordinary Shares; secondly, the Interim Dividend in January, 1960, was paid on the Capital as increased by the Capitalisation Issue in February, 1959, and thirdly, the proposed Final Dividend is at the rate of 10% as compared with 7½% for the previous year.

### Balance Sheet

#### LIABILITIES

The Issued Capital was increased by £422,400 in February, 1959, by the Capitalisation Issue, which depleted the Capital Reserves by £241,980 and the Revenue Reserves by £180,420. By transferring the above-mentioned sum of £430,420 to General Reserve we have restored the combined Capital and Revenue Reserves to approximately the figure shown in the last Balance Sheet. The Shareholders' interests, consisting of Capital, Reserves and Unappropriated Profits, amount to £5,363,743, an increase of £465,023 over the previous year.

The remaining items show relatively little change from the previous year and do not call for comment.

#### ASSETS

The value after depreciation of the revenue-bearing Installations has increased by £307,053 to £4,071,524.

Office Furniture and Fittings, Vans and Cars are up by £8,494, whilst the Freehold and Leasehold Properties show a decrease of £7,704.

The increase of £22,738 in Investments in Subsidiary Companies represents an addition to our Shareholding in the Canadian Companies. The accumulated Canadian losses are still adequately covered by the Contingencies Reserve. Loans to Subsidiary Companies were repaid during the year, whilst the amounts due on current accounts have decreased by £2,726.

Of the Current Assets, neither Stock and Work in Progress, nor Sundry Debtors and Prepayments reflect much change, although as already mentioned we expect to see the Stock figure somewhat higher at the end of 1960.

Our Liquid Resources consisting of Tax Reserve Certificates, Deposits with Local Authorities, Investments and Cash are some £325,643 greater than at the end of 1958, some of the surplus funds having been invested in short-dated Government Stocks.

### Consolidated Balance Sheet and Profit and Loss Account

The Consolidated Accounts having been prepared on a similar basis to that of the Parent Company, the material changes have already been dealt with in the foregoing remarks.

As previously stated, the Net Profit before Tax is £1,294,581, and after providing for Taxation, transfers to Reserves and Dividends, the balance of unappropriated Profits carried forward and attributable to the Holding Company's Shareholders amounts to £420,486.

### Tribute to Employees

In conclusion, I am sure you would wish me to pay a tribute to the ungrudging hard work and willing co-operation of the employees in all sections of the Organisation at home and overseas, without which the results of this quiet outstanding year could not have been achieved.

It is no exaggeration to say that, largely through the influence of the Profits Participation Scheme, the interests of the employees and the interests of the shareholders have become identical. To a remarkable degree our employees are conscious of a sense of personal responsibility for the progress and well-being of the Company. Many of them will benefit from the raising of the dividend rate and I can assure you that they will have amply earned the additional recompense.

From the point of view of the shareholders, the most valuable asset is one that does not appear in the Accounts at all—the loyalty and enthusiasm of the men and women who work for the Company.

The report and accounts were adopted and the dividends, as recommended, were approved.

The retiring directors, Mr. F. C. T. Lane, F.C.A., Mr. J. H. Reed, C.B.E., A.C.I.S., and Mr. Campbell Cochran, B.L., were re-elected, and the remuneration of the auditors, Messrs. Chas. W. Rooke, Lane & Co., was fixed.

The special Resolution amending the Articles of Association having been passed, the proceedings terminated. 4867

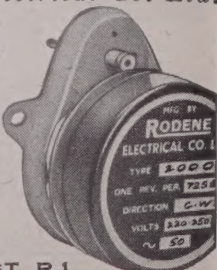
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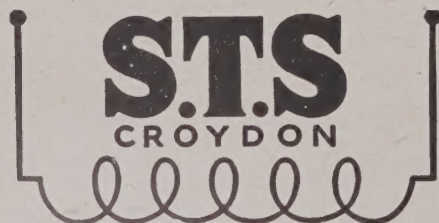
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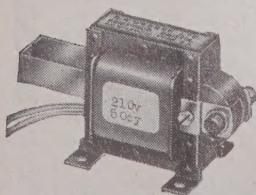
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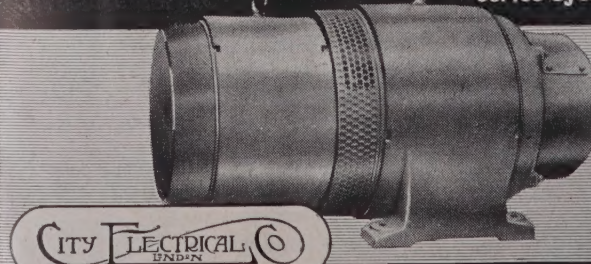


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